Rock Products

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Shot in the lower ledge of the Tennessee Cement and Lime Co.'s quarry. The 18 holes loaded according to the rock gave good fragmentation and a recovery of 4.23 tons per pound of dynamite

Mining Two Ledges for Crushed Rock and Kiln Stone

Unusual Blasting Practice at the Tennessee Cement and Lime Company Quarry, at Summitville, Tenn.

By J. R. Thoenen
Mining Engineer, Greenville, Ohio

THE kilns and quarry of the Tennessee Cement and Lime Co. are located at Summitville, Coffee county, Tenn., on a branch of the Nashville, Chattanooga & St. Louis Railway which connects with the main line at Tullahoma.

The company is owned and operated by R. F. and A. S. Overall of Murfreesboro, Tenn., with R. C. Miller as plant superintendent.

Limestone is quarried by the open pit method from a massive deposit contained in a hill locally called Round Mountain, which rises rather abruptly for approximately 120 ft. above the surrounding flat agricultural terrace. The hill is the result of erosion rather than of volcanic action. Formations dip 1 deg. 45 min. to the southeast and strike north 49 deg. east.

The limestone is massively bedded, fine grained and comparatively hard, containing 97% calcium carbonate and 1% magnesium carbonate.

The ledge as quarried for lime is roughly 45 ft. thick, overlying a massive limestone containing silica in the form of flint nodules and particles finely disseminated through the mass. Above the commercial stone occurs a yellow to brown limestone carrying large quantities of silica in flint nodules. This upper stratum is badly eroded and covered by the usual residual clay mantle.

Here, as at many other quarries, the problem of overburden removal has become of increasing importance owing to the advance of the quarry face into the hill. In preparation for future operation surveys have been made and an underground mining scheme designed by the writer. While the need for underground production is not of immediate moment, the advantage of an early start in this direction is recognized. Much of the immediate future production will come from underground operations, but it is planned to open tunnels and operate them in connection with the open quarry. The object of this is to provide working space for the quarry force during inclement weather and to gradually accustom local personnel to mining operations against the time when the whole production must come from underground.

The cycle of operations at the quarry is as follows:

Overburden (clay) is first removed by hand loading into 2-yd. Western side-dump cars and pushed to the dump at the edge of the hill. Then holes are drilled by well drills to the top of the commercial or kiln stone. The top stone is then shot down onto the quarry floor (after all kiln stone has been cleaned up). It is loaded by hand on contract and hauled by a 4-ton Plymouth gasoline locomotive to the crushing and screening plant, where it is converted into railway ballast, screenings and agricultural stone.

While this material is being removed at one end of the quarry, kiln stone is being quarried at the other, which obviates all danger of any mixture of the two materials.

After removal of the top rock the kiln stone is drilled and shot in regular open quarry manner, using the same drilling equipment as on the top stone.

Start and end of blast. The unusual picture at the left was taken just as the shot was fired. The picture at the right was taken immediately after and shows the stone thrown forward by the shot

Top-stone for crushing and kiln stone are loaded by hand onto dump cars

Laying out holes for the blast. The holes were unequally spaced and carried different burdens

The kiln stone is loaded on contract into 2-yd. Western side-dump cars and hauled to the kiln track by the Plymouth locomotive before mentioned. It is there picked up by a Baldwin 14-ton saddle tank dinky and hauled up a 3% grade to a trestle at the tops of the kilns around the shoulder of the mountain. Storage is provided at the kilns for surplus kiln rock by a raised dump track parallel with the main line to the kiln trestle. This stored material, being level with the kiln tops, can be loaded by hand and pushed to the kilns without the aid of the locomotive.

Crushing and Screening Equipment

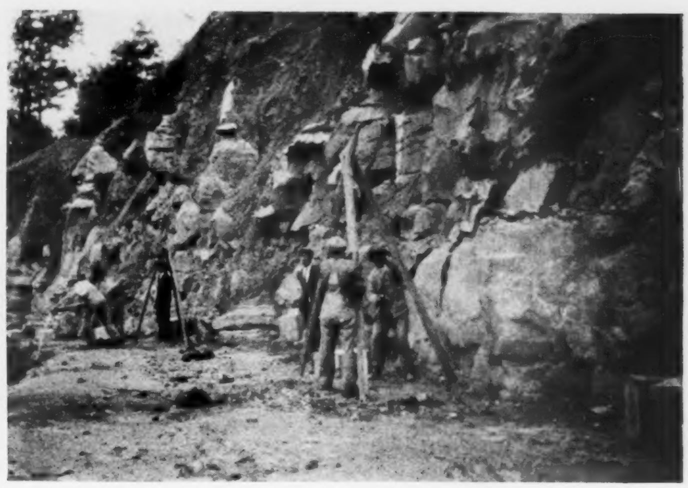
The top rock is dumped from the cars on the quarry floor to a No. 5 Gates gyratory crusher set 8 ft. below the track. The crushed stone is elevated by a 7x14-in. bucket-belt elevator on 70-ft. centers and discharged into a 36-in.x12-ft. revolving trommel fitted with a ¼-in. mesh wire screen dust jacket. Three sizes of stone are made: 2½-in. to 1¼-in., or railway ballast, sold to the N. C. & St. L. Ry.; 1¼-in. to ¼-in., or screenings, sold to the trade in competition with gravel as concrete aggregate; and ¼-in. dust as agricultural stone. The approximate percentage of production is 75% ballast, 20% screenings, and 5% dust. The plant capacity is 100 yd. daily.

Lime Plant

Kiln stone is dumped by hand into five 6½x30-ft. wood-fired egg-shaped kilns fitted with 6-ft. cooling cones below. Burned lime is drawn through hand-operated shear gates into steel barrows on the cooling floor. Lime is packed in jute bags or wooden

Section of the quarry face showing the peculiar limestone formation

Loading blast holes



Stemming and tamping the charges

barrels as "Dixie" lump or bulk lime or sent to an Austin No. 2 gyratory crusher. The crushed lime is elevated by a 7x14-in. bucket-chain elevator to a Raymond mill and two Clyde hydrators.

Wood is used almost exclusively for burning, although a small quantity of coal is used at times. The annual capacity of the plant is 4000 tons of bulk lime and 6000 tons of hydrated lime.

Power

Both lime plant and crushing plant are driven by steam at the present time, although provision has been made to take electric power from the lines of the Southern Cities Power Co. in the immediate future.

Details of a Quarry Blast

On October 30, 1926, at 12 noon the company fired 18 well drill holes under the direct supervision of W. O. Dunn of the Grasselli Powder Co.

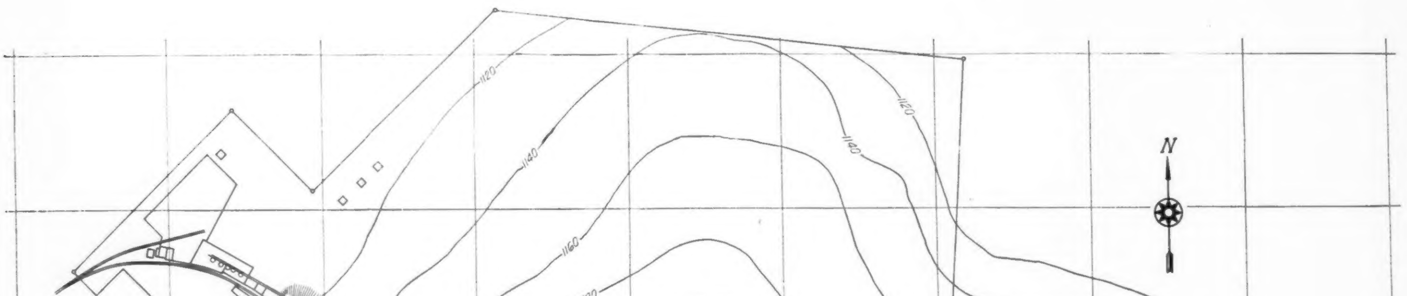
Owing to irregularities in the quarry face these 18 holes were not equally spaced, nor did they have a uniform burden. This resulted in the necessity of a very careful loading program and the computation of each load as a separate shot, although all holes were shot together. It was desired that the stone be well scattered over the quarry floor, shot free from the quarry face, and well broken up, but with a minimum of waste spalls. The conditions under which the shot was fired and the explosive charges are shown in the accompanying tabulation.

The blast fulfilled all expectations, so far as could be immediately determined, in that the stone was spread over the quarry floor, well broken up, and no excessive spalling was observed. Practically no stone was thrown out of the quarry. Although several immense boulders were thrown down, these upon close examination were found to be cracked and shattered in all directions, making secondary blasting a minimum charge. The stone was thrown clear of the quarry face so that 95% could be recovered without workmen entering the zone of danger from loose material on the face.

Computations show that 4.23 tons of stone

SPACINGS, DRILLING AND LOADING DATA OF OCTOBER 30 BLAST

					——Loaded——			
Hole	Depth ft.	Space per Hole, ft.	Burden ft.	Tons per Hole	lb. 60% powder	lb. 40% powder	Total Load, lb.	Tamp
1	30	15	17	638	100	100	200	11 ft. 6 in.
2	40	15	15	750	100	120	220	15 ft. 0 in.
3	39	18	15	877	100	150	250	13 ft. 0 in.
4	40	25	14	1120	100	144	244	11 ft. 0 in.
5	29	25	17	988	......	181	181	13 ft. 0 in.
6	39	15	16	780	100	125	225	14 ft. 0 in.
7	40	17	16	907	100	125	225	15 ft. 0 in.
8	35	17	14	694	100	100	200	11 ft. 0 in.
9	40	16	17	907	100	125	225	15 ft. 0 in.
10	40	17	17	960	100	150	250	12 ft. 6 in.
11	40	17	19	1076	100	150	250	12 ft. 0 in.
12	40	17	19	1076	100	150	250	11 ft. 0 in.
13	39	18	21	1683	150	100	250	8 ft. 0 in.
14	39	17	23	1239	200	......	200	12 ft. 0 in.
15	40	16	24	1228	150	100	250	10 ft. 0 in.
16	37	16	15	740	150	50	200	11 ft. 0 in.
17	27	13	17	498	100	......	100	14 ft. 0 in.
18	39	13	10	422	100	100	211	13 ft. 6 in.
Totals				16,583	1,950	1,970	3,920	



Proposed underground mining scheme for future quarry operations

Hydrating plant and loading platform and tracks

Battery of lime kilns under trestle

was broken from the face per pound of explosive used, but in several places there was a considerable overbreak. At both ends of the line of holes the ledge broke beyond the calculated area. Between the holes in many places the break was unusual in that it cut back into the quarry face behind the holes in a saw-tooth fashion, leaving the holes on the points of the teeth. The ratio of stone to explosive will probably run to over 4½ tons per pound.

The explosive used was Grasselli 60% and 40% L. F. Gelatin in 4x8-in. and 4x10-in. shells. Detonation was made through Cordeau-Bickford fired by a No. 6 cap and 6 ft. of single tape safety fuse.

The large diameter holes and the smaller cartridges undoubtedly resulted in some voids in the charging, but little actual difference was found in the space taken up by the dynamite charged loose, split, or uncut when tamped in place.

Fine stone dust was used for stemming without tamping.

Loading was started at 7.45 a.m. and completed at 10.45 a.m. and the blast fired at noon.

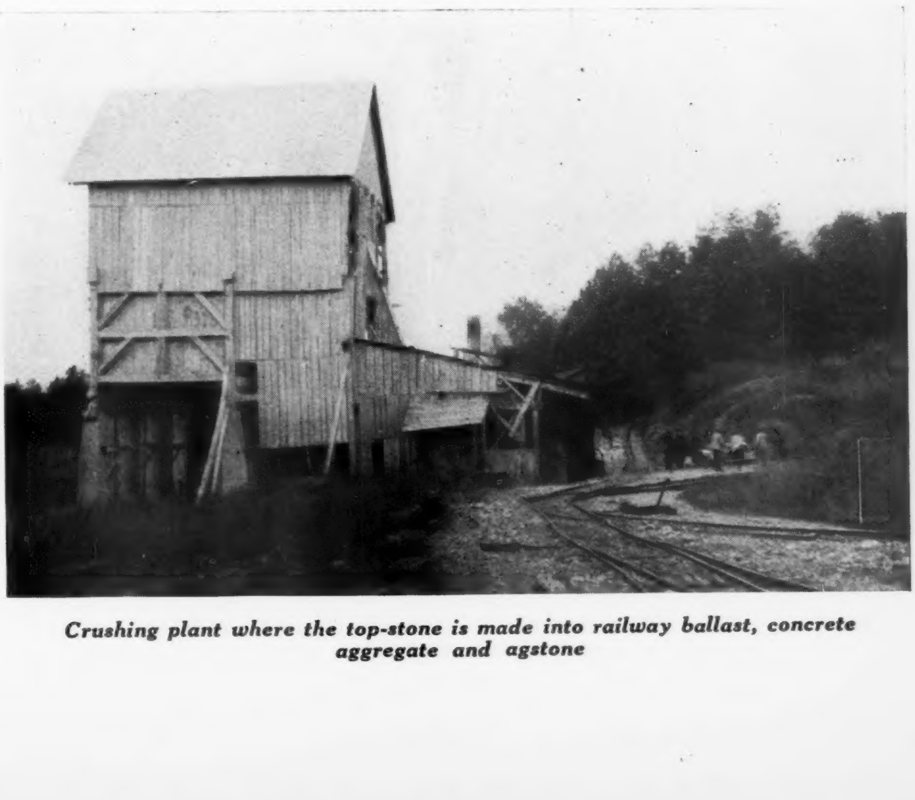
Development of the Diamond Drill

THE diamond drill, which was invented about 1863 by Robert Leschot, a French engineer employed on the Mont Cenis tunnel, is the oldest form of the core drill, states the Bureau of Mines, Department of Commerce, in a recently issued bulletin. In his youth Leschot had been a watchmaker and had thus become familiar with the wearing qualities of the jewels in watches. Observing that the steel in the bits used to bore holes for blasting wore out quickly in the hard rock, he conceived the idea of setting diamonds in the bits to make them wear longer, probably using white diamonds instead of the black stones.

The diamond drill was first used in the United States during the late sixties at the Vermont marble quarries, before the steel saw had been invented for cutting out blocks of marble. Instead of a steel saw being used to cut the marble into blocks, as is now the practice, a series of small diamond-drill holes was bored along the line of the slab. Some of these machines were so built that they rotated two bits simultaneously. As soon as one pair of holes was finished, the machine was moved a little more than the diameter of the hole and another pair of holes was drilled; in this way a cut was made along practically the entire line of the slab. This bit, known as a bore head, was solid and cut no core.

M. C. Bullock saw the advantage of this drill for prospecting and bought the American rights to the Leschot patent. The earliest exploration work with the diamond drill was probably in the Pennsylvania coal fields, where in 1872 a hole 700 ft. deep was sunk by the diamond drill. It is interesting to contrast this hole with the 7347-ft. hole drilled with a diamond drill by the Imperial German Government near Czuchow, Upper Silesia, Germany, in 1909.

In the early seventies the diamond drill was used in drilling holes for blasting out the well-known Hell Gate reef, which long had menaced navigation in New York harbor. About that time the Michigan copper and iron ranges were being explored and developed and the diamond drill was first used extensively there. Although many details have been changed, the principles of diamond drilling have practically not changed since the diamond drill was first used.



Crushing plant where the top-stone is made into railway ballast, concrete aggregate and agstone

The dredge working into one of the islands, in the Willamette river, owned by this company

New Dredging Plant at Portland, Oregon

Ross Island Sand and Gravel Co. Has a Fine Dredge With an Unusual System of Handling Material

THE plant of the Ross Island Sand and Gravel Co. of Portland, Ore., attracted a great deal of attention throughout the country when it was built in the fall of 1926 on account of the peculiar situation in the local sand and gravel industry which it created. Operations were started on and around islands in the Willamette river, privately owned, which the company purchased. The state of Oregon collects a royalty of 10 cents a cubic yard for all gravel taken from the Willamette and it gave the new company a great advantage over its competitors to be able to produce gravel from privately owned sources without paying royalty. The question was whether or not the state owned the water near the island. Fortunately the matter was settled in a sensible fashion by a survey and a definition of lines outside of which the gravel taken should pay royalty and a bad "gravel war" and an expensive law suit were avoided.

The fact that the gravel was to be taken from shallow water and near the shore influenced the choice of equipment. Practically all the dredges on the Williamette except that of the Ross Island company are of the clamshell type. They operate in deep water, in the channel of the river, taking the gravel sometimes from a depth of 70 ft. Under such circumstances it is possible to use a pump dredge but the long suction and cutter (which would be necessary in pumping from the hard river bottom) would be awkward to handle and would require a hull of unusual size and length. A suction ladder at least 100 ft. long would be needed. So the clamshell type of dredge is usually chosen for this work. But working in shallower water the Ross Island company can operate a pump dredge of the usual type with a 50 ft. ladder.

The dredge is one of the best that has been built on the Pacific coast. The hull is of unusually heavy timber construction stiffened with four longitudinal bulkheads and cross bracing. It is 80 ft. long, 30 ft. wide and 5 ft. deep. The usual width for an 80 ft. hull in the dredging practice on the rivers of the Middle West is 26 ft. The extra 4 ft. of width in this hull gives considerably more stability and provides necessary space for walkways. All the machinery is enclosed in a well built cabin which is more heavily sheathed for the first 4 ft. from the deck according to the best marine practice.

The dredge pump, made by the American Manganese Steel Co., has a 12-in. discharge and marine type thrust bearings. It is direct-connected to a General Electric motor of the variable speed type which operates on 2300-volt current. The speed

Dredge of the Ross Island Sand and Gravel Co., Portland, Ore., one of the few suction dredges near Portland and one of the best built on the Pacific coast

with the present length of pipe line is 414 r.p.m.

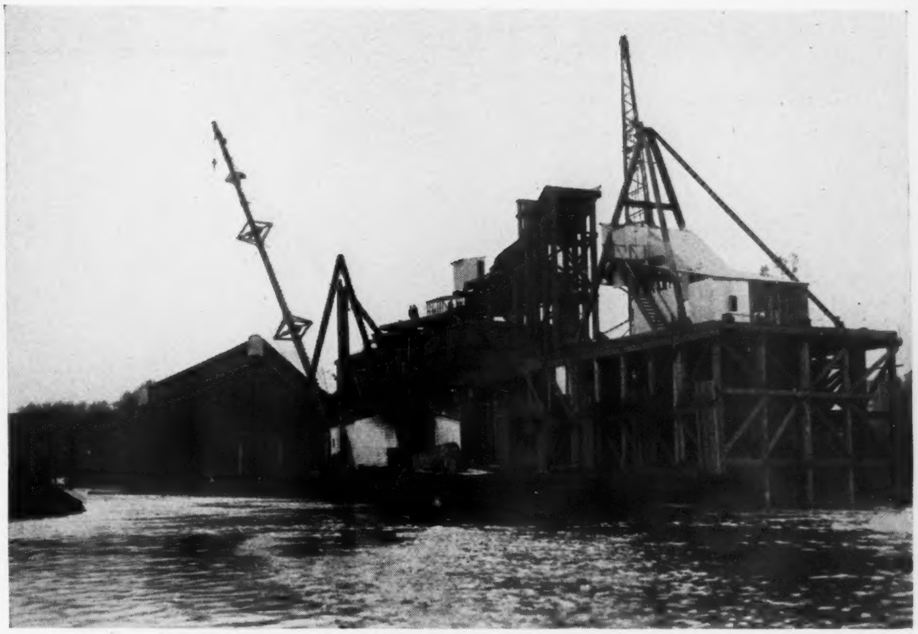
Current (2300-volt) is brought to the dredge by a submarine cable, lead covered, with three conductors. This is not as usual in sand and gravel dredges as bringing in the current on poles erected in pontoons, but it is the method used with large contracting dredges and other machines that work in wet places. A large reel provided with collector rings holds 1000 ft. of this cable and allows the dredge to be moved without putting any strain on the cable.

The pump control (in the pilot house) is of the drum type and near it are the controls for the cutter, auxiliary pump and the hoist for handling the lines. The pilot house has plenty of windows in front and sides. Two men do all the work of handling the dredge.

The suction is a pipe of high carbon steel carried on a ladder that holds the cutter which is a Swintek traveling suction screen used to dig the compacted material, to keep a steady inflow of solids coming to the suction and protect the pump from too large pieces and trash. This is driven by a 25 hp. motor through an Allis-Chalmers "Tex-rope" drive, one of the first instance in which this has been applied to dredge work. The "Tex-rope" is made up of round belts of special weave which fit into V-shaped grooves on the pulleys. It does not depend on tension for the pulley grip and may be used with much shorter pulley centers than ordinary types of belts.

For handling lines there is a 6-drum hoist. One drum raises and lowers the suction ladder and cutter and the other five are used for the lines, which run either to the shore or anchorages, by which the boat is manouvered in dredging. This hoist was made by the Hesse-Ersted Iron Works, Portland, Ore.

For priming there is a 2-in. two-stage Byron-Jackson centrifugal pump driven by a 25 hp. induction motor. This is also used



Plant of the Ross Island Sand and Gravel Co. seen from the river. Derrick on structure lifts pump discharge to screens

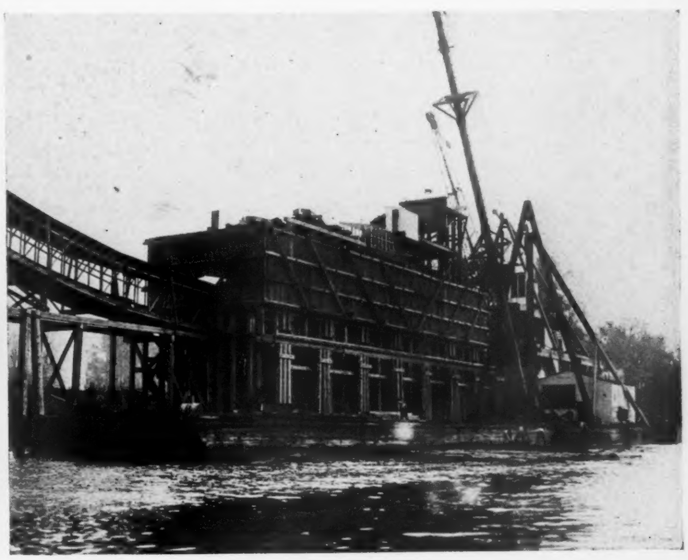
for furnishing pressure water to a "jet elevator" or "ejector" which is used for siphoning water from the hulls of barges.

There are two features in which this dredge differs from dredges of the same size and type which are used in the middle-west and eastern fields. There are no spuds and the suction ladder is not supported by a framework and pontoons. The elimination of spuds is probably compensated for in the length and weight of the hull. The omission of supporting pontoons is possible from the manner in which the suction is handled. This is by the use of an A-frame of unusually strong construction which is held by cables to two frames of heavy timbers carried by the hulls. These frames are connected and held fore and aft by rods and turnbuckles. When the suction is being hoisted the whole weight of the hull and machinery opposes the weight of the ladder and keeps it from pulling the bow under water.

The discharge line is of specially constructed high carbon steel welded pipe. It is carried on pontoons which are built up of wood staves. They are 12 ft. long and 30 in. in diameter and have three cross braces inside.

The connection between the dredge and the washing and screening plant is unusual if it is not unique. Instead of using a dewatering elevator, self-dumping barges, a dewatering sump, or some of the other methods that are in use in other places, the method in this case is to lift the material from under water by a stiff-leg derrick and 2-yd. Williams clamshell. The derrick, which has a steel frame and boom, is mounted on a heavy timber framework and piling. The dredge pumps to a point near this and the derrick lifts the material and

Conveyor which fills underwater storage and also communicates with cableway to railroad



Land side of plant. The derrick boat is used to recover material from storage

deposits it in a plant hopper which is 86 ft. above the water at the normal stage of the river. The derrick and 200-hp. hoist were made by the Hesse-Ersted Co. of Portland.

Since the pump does not have to lift the material, and all the water which accompanies it, this 86 ft., the radius of the dredge, is greatly increased over what it would be otherwise. At the usual pipeline velocity of sand and gravel dredges the friction on 100 ft. of pipe is equal to about 7 ft. lift. Hence the lift for this 86 ft. would be roughly the same as the friction on 1200 ft. of pipeline. By using another machine than the pump to lift the material to the hopper, the dredge is enabled to work at a much greater distance from the plant with the same power unit.

The sump into which the pump discharges and from which the material is taken by the clamshell is excavated to a depth of 20 ft. and enclosed in sheet piling.

All the material goes to a three-jacketed screen which is 20 ft. long in the main section. The outer jacket is 9 ft. in diameter. Sand and water passing through the outer jacket go to four Allen cones, where the sand is classified into two products. The gravel passing the screens is in 1-in., 2-in. and 3-in. sizes and falls into pockets or bins underneath. The oversize goes to a No. 10 Allis-Chalmers Superior McCully reduction crusher and falls into the sump from which it is lifted by the clamshell and thus goes again to the screen.

The bins are so arranged that the contents may be loaded into barges or railroad cars or sent to storage. A 24-in. Dodge belt conveyor takes the material from the bins when it is to be sent to storage. This conveyor deposits it along the end of the plant where storage piles are built up in the water. The discharge is made at the required point by means of a Dodge tripper. The material is removed from storage by a chamshell with a stiff-leg boom derrick mounted on a barge. The conveyor is driven by a tex-rope drive in the place of reduction gears.

When the material is to be loaded on cars it goes by the conveyor to the terminal of a Leschen wire rope tramway which takes it to the railway cars and retail bunkers located about 1800 ft. from the plant. This tramway has a capacity of 90 yd. per hour as a minimum. Bins at the discharge end load by chutes into railway cars.

To permit barges to be loaded at the storage piles and beside the bins a great deal of dredging had to be done. It was also necessary to dredge a channel to the main channel of the river, but since this has been done there is ample depth for craft of ordinary draft to go right up to the plant.

The pump will deliver 150 to 200 yd. per hour of solids, and this output is attained with a small labor force.

General Electric motors are used on the dredge, and Allis-Chalmers motors throughout the plant. Especial care has been taken to reduce wear and tear by protecting wearing parts and making parts large enough. Thus all drums and sheaves are 36-in. in diameter to avoid undue bending stresses or cables and all conveyor head pulleys are lagged to prevent slipping and consequent wear on the belt.

The dredge pumps to underwater storage near the plant. Note wood stave pontoons used to support pipe line

All the construction and installation was done under the direction of Harold Blake, the present manager of the Ross Island company's operation.

The office of the company is in the Lumbermen's Building, Portland. D. L. Carpenter is president; W. H. Muirhead, vice-president; Harold Blake, vice-president; Henry W. Hughes, treasurer, and Jay Bowerman, secretary.

Talk of Building Boom Questioned

THE activity in construction in the United States which has marked the years following the war has been rather generally characterized as a building boom. The accuracy of such characterization has been questioned in a late bulletin of the International Cement Corp., which offers these facts:

In pre-war years the annual volume of building in the United States was about $3,000,000,000. That was considered a normal condition. Last year the total volume of building was approximately $7,000,000,000. But in 1925 it took $1.89 to buy what $1 bought in 1913. At 1925 prices, 1913 would have been a $5,300,000,000 building year. At 1913 prices, 1925 would have been a $4,000,000,000 building year.

It is figured on this basis of consideration that if 1913 was normal with its three-billion-dollar building record, 1925 with what at 1913 prices would have been a four-billion-dollar building record, could scarcely be called abnormal. So the opinion is warranted that building operations are being carried on over the country as a whole at a rate which does not represent a boom at all, but merely a maintenance of the normal rate of construction.—*Dallas (Tex.) Journal.*

Sand and Gravel Production in 1925

THE following table issued by the Bureau of Mines, Department of Commerce, gives the sand and gravel production of the United States for 1925. The corresponding total estimated by ROCK PRODUCTS from the reports of producers who answered questionnaires, and published in the 1925 Annual Review and Directory Number was 170,000,000 tons as compared with 172,000,000 tons estimated by the Bureau of Mines.

Sand and Gravel Sold or Used by the Producers in the United States, 1924-1925

	1924		1925	
Use	Short tons	Value	Short tons	Value
Sand:				
Glass	2,169,899	$3,718,973	2,334,921	$3,836,085
Molding	4,403,893	4,995,268	4,995,428	5,400,618
Building	41,376,425	23,455,393	45,287,240	26,306,463
Paving	20,707,875	11,595,499	24,876,814	13,659,228
Grinding and polishing	1,756,058	2,707,583	1,824,449	2,525,180
Fire or furnace	237,143	291,175	343,716	392,932
Engine	2,024,930	1,344,935	2,261,635	1,395,890
Filter	74,828	150,239	106,462	249,141
Other	2,820,959	585,400	5,151,557	1,382,788
	75,572,010	$48,844,465	87,182,222	$55,148.325
Gravel:				
Building	30,486,874	$22,718,803	32,759,151	$24,589,689
Paving	28,830,336	18,773,832	32,574,570	21,411,672
Railroad ballast	21,340,843	6,676,015	19,485,530	6,392,437
	80,658,053	$48,168,650	84,819,251	$52,393,798
Grand total	156,230,063	$97,013,115	172,001,473	$107,542,123

Plant of Southern Gypsum Co.—Recently Purchased by the Beaver Products Co.

A Gypsum Deposit with a History Dating Back to the Days Before the Civil War

THE operation of the Southern Gypsum Co. at North Holston, Va., has a historical interest because the deposit was worked at this place for many years before the Civil War. Old log dams and bulkheads still remain as evidence of this work. Part of the material taken out in early days was ground at the mine and part of it was shipped on flat boats down the North Holston river to a small mill. All this production was used for land plaster, for the use of gypsum for wall plaster and gypsum products was hardly known in those days.

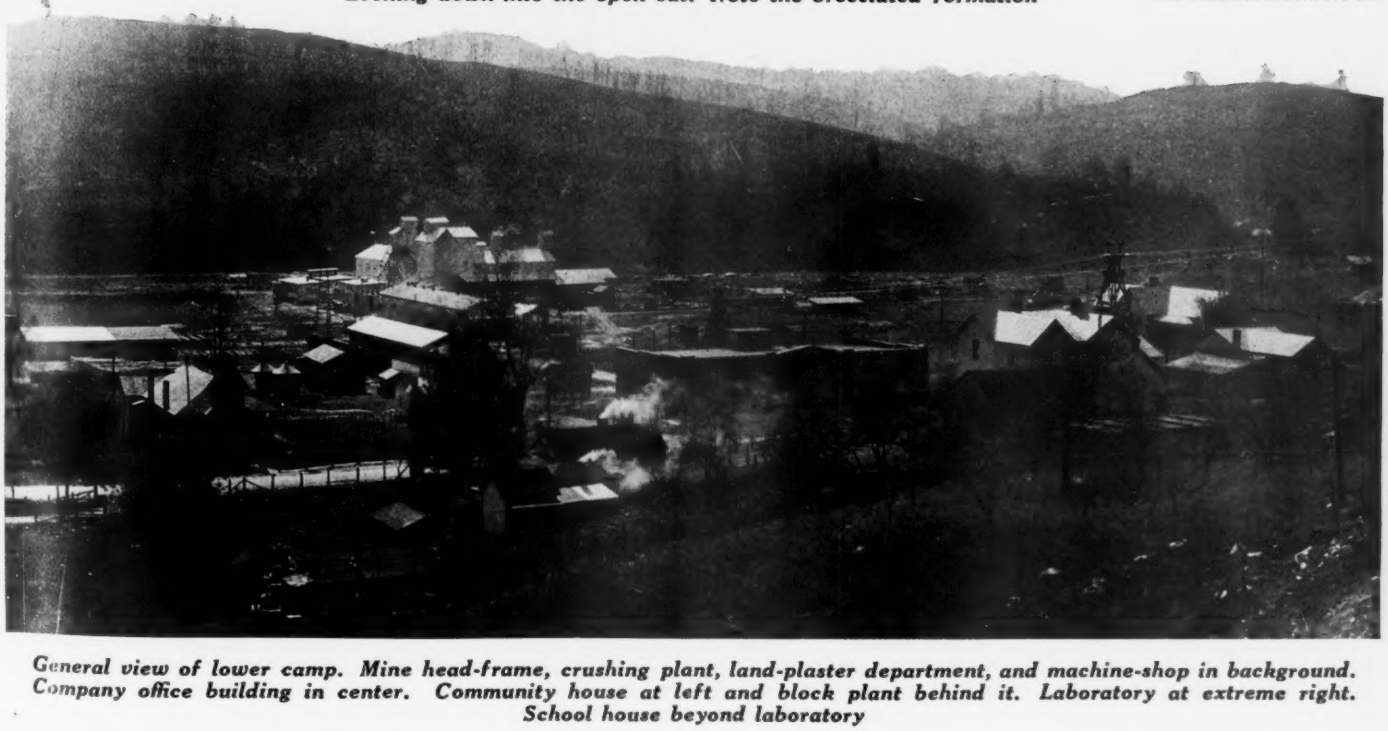
The deposit lies along a great fault that is said to run from Pennsylvania to Georgia. Another deposit on this same fault is worked by the United States Gypsum Co. at Plasterco, four miles from North Holston.

Looking down into the open cut. Note the brecciated formation

Some of the gypsum has been taken out by quarrying at North Holston, or perhaps open-cut mining would describe it better, but at present all the work is underground. The greatest depth so far attained is about 400 ft. below the surface.

The mining method employed is interesting. In opening a stope a raise is carried up on an incline, the angle varying according to conditions, but of a slope sufficient to run the broken rock by gravity to the bottom of the raise. At the top the rock is chambered out by overhand stoping. The raise is widened at the same time to 30 or 35 ft. Then the toe of the slope is cut off and the bottom taken out by underhand stoping, the grade being maintained so that the rock will always flow to the level of the drift The last cuts bring the incline down to the level of the drift, thus recovering all the rock.

J. W. Austin, the mine superintendent who has had considerable ex-



General view of lower camp. Mine head-frame, crushing plant, land-plaster department, and machine-shop in background. Company office building in center. Community house at left and block plant behind it. Laboratory at extreme right. School house beyond laboratory

Incline from shaft and hoist house—primary crushing plant in the rear

New primary crusher house, hoist, head frame and land plaster plant

perience in mines throughout the west, and who is a graduate mining engineer, says that he found this system in use when he took charge and that he has not yet discovered a way to improve it. The system would seem well adapted to working out irregular shaped bodies such as are found in this deposit. Mr. Austin says that it has been successfully used in some iron mines.

The drilling is with Hardy drills. The Hardy is a light-weight machine made in England and it was chosen as the result of a competition in which both English and American drills were tried. Recently another competition was held in which some American drills made nearly as good a record, and it is probable that one of these will be chosen owing to the high cost of imported repair parts. Sullivan light model drills are already in use for putting in down holes as this machine has shown itself somewhat more advantageous for down-hole drilling than its English competitor in recent competition tests.

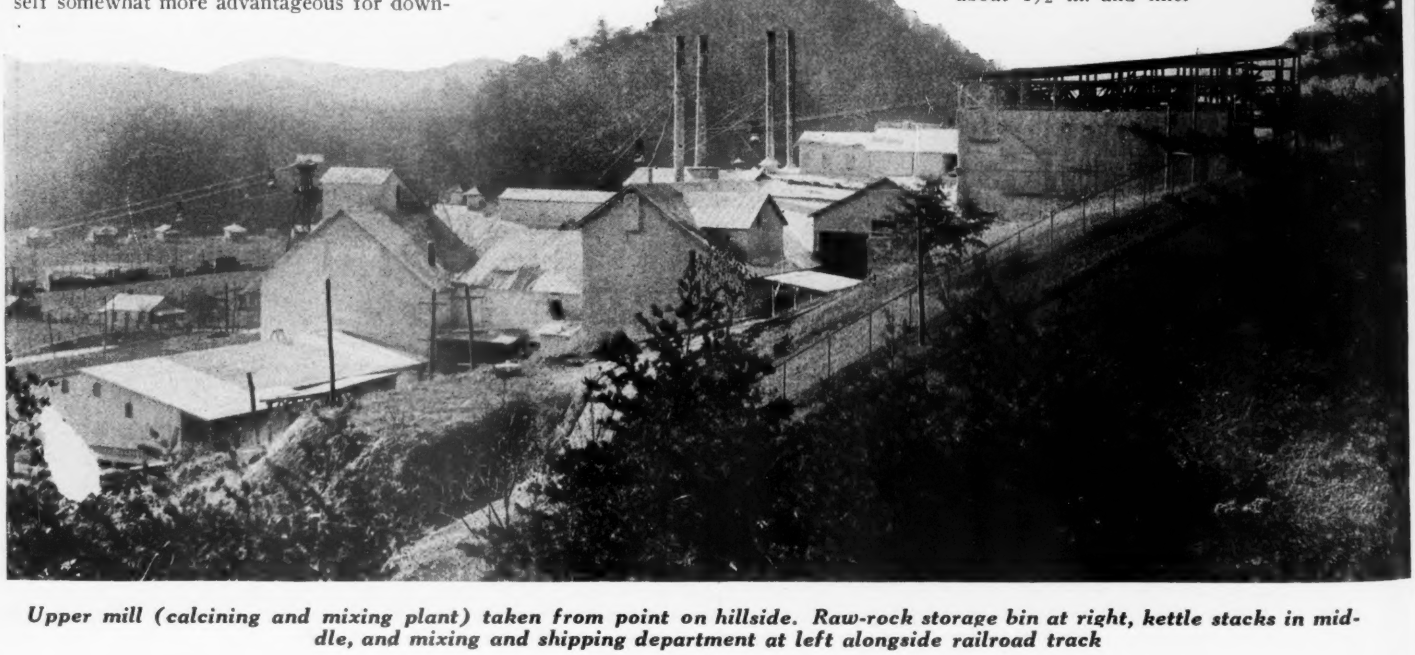
Air for the drills is furnished by a Worthington 1300 cu. ft. compressor, made at the Laidlaw shops. It is driven by a 125-hp. General Electric synchronous motor. This compressor has the automatic setting control by which the machine is automatically set to run at no load, quarter-load, half-load, three-quarter-load and full load, according to the demand. Under all conditions the compressor runs smoothly and almost silently, owing to this adjustment to the load.

Skips are not used in hoisting but the effect of a skip is secured by a dumping cage which holds the car in place and dumps it into the receiving bin. The cars are Sanford-Day cars with roller bearings and hold 2 tons. They are hoisted by a double-drum Lidgerwood hoist which works in balance, one car going up while the other goes down. The dumping cage was made by the Eagle Iron Works, Des Moines, Iowa.

The shaft has a 200-ft. vertical section which rises to the surface. Below this is a 200-ft. section which is on an incline.

From the receiving bin the rock goes to a 30 x 36-in. Farrel jaw crusher. Everything passes through this and goes on a 36-in. belt of 38 ft. centers. This is used as a picking belt when necessary, so that any lumps of low-grade rock may be thrown out.

This belt carries the rock to the hopper of a Butterworth and Lowe pot crusher, where it is reduced to about 1½ in. and finer



Upper mill (calcining and mixing plant) taken from point on hillside. Raw-rock storage bin at right, kettle stacks in middle, and mixing and shipping department at left alongside railroad track

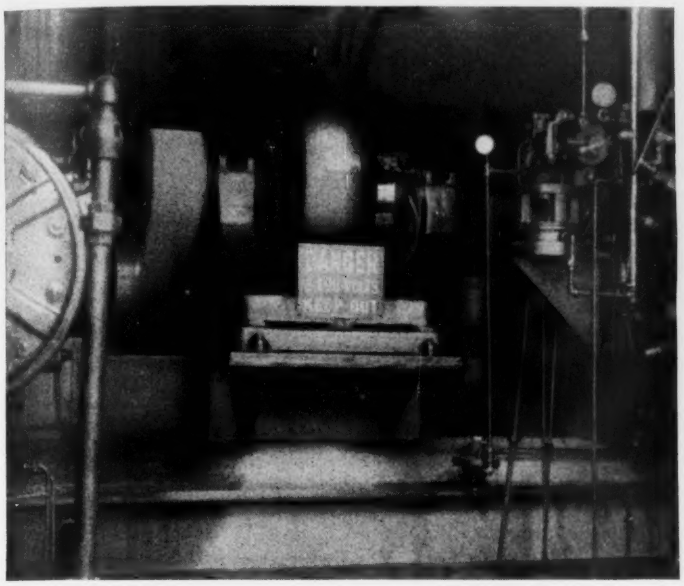
in size. From this a 24-in. belt, 128-ft. centers, takes it to the storage bins.

The primary crusher house with the crusher and belt system described has recently been installed and the installation was just being completed when the plant was visited. It is an excellent piece of work with all the foundations of concrete and the belts supported on substantial steel structures.

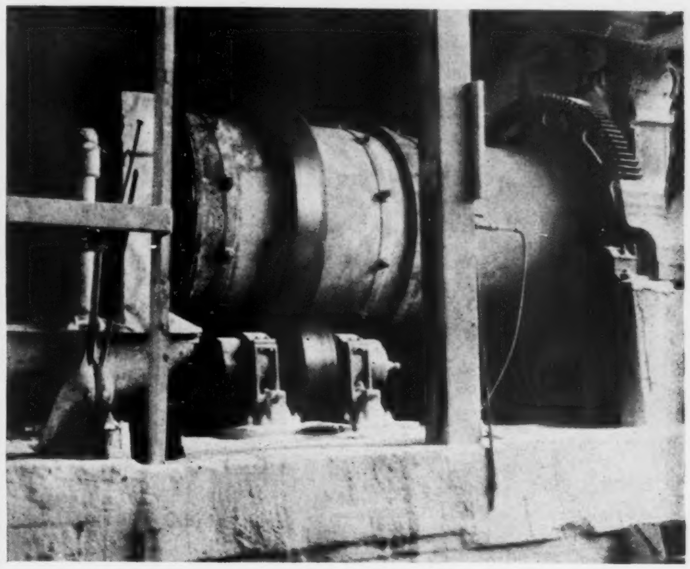
There are three bins, one for land plaster rock, one for "cement rock" and one for "plaster rock." The land plaster material goes to Raymond mills by which it is ground so that 95% passes 100-mesh and then it is sacked for shipment. The "cement rock" is shipped directly from the bins to cement companies to be ground with cement clinker for a retarder. The "plaster rock" goes by a Broderick and Bascom aerial tramway to the plaster mill, which is on a hillside perhaps 2,000 ft. distant.

About 10,000 tons of crude rock is carried in storage to provide against temporary interruption of supply from the mine.

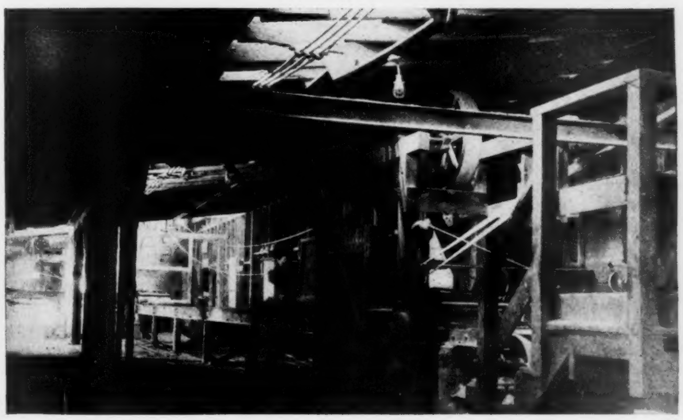
At the end of the tramway is the receiving bin of the plaster mill which was quite recently built. It holds about 2,000 tons and is solidly constructed of concrete. Below this bin are two Raymond mills of the 4-roller type in which the plaster is ground for calcining.



Air compressor with automatic control



Rod mill changed to ball mill for fine grinding



Interior of board plant showing board machine designed and built by the company. Plaster board and not wall board is made on this machine

Top of one kettle in calcining plant. Recording thermometer in box at left. Vertical (sloping) pipe carries dust from hot-pit to collector bin

These mills are fitted with the automatic feed device, controlled from the air separation system which is an integral part of the Raymond mill. The device is said to be very satisfactory in its operation, not only giving an even feed to the mill but producing an exceptionally uniform product for the calciners.

There are no dryers in the plant for the rock in the mine is dry and all the places through which it must pass, except the tramway, and the storage bins are covered from the weather. The heat produced in grinding is sufficient to care for any moisture there may be in the rock so that a good separation may be made in the air separation system.

From the mills the ground rock goes to a concrete bin above the kettles. There are four kettles, two of which were installed during the past year. They were built at a foundry and machine shop at Pulaski, Va., which is not far away, to the company's own designs and specifications. The new kettles are of the usual type except that the course of the hot gases through the flues is somewhat different from the common practice. All the kettles are set over the hot pit and the usual screw conveyors and a hot elevator take the stucco to the bin above the ball mill.

The main ball mill is a Marcy mill made by the Mine and Smelter Supply Co. of Denver, Colo. Originally it was run as a rod mill, as it was designed to be run. But an investigation carried on for some time showed that balls were better adapted to the very fine grinding required than rods, so the substitution was made. It makes a very satisfactory ball mill.

An Allis-Chalmers ball mill of the short type is used as a reserve and both mills are run at the peak of the shipping season.

Elevators and screw conveyors take the ground stucco to the mixing department, which is on the other side of the shipping

Fire-box door and lower part of one of the kettles

track from the ball mills.

Three calcined gypsum products are made by the Southern Gypsum Co., wall plaster, plaster board and gypsum block. The plaster and plaster board plants are in the group of buildings around the calcining plant. The block plant is near the crushing plant but it is supplied with its material from the plaster plant. Stucco is mixed with shavings and sent down to the block plant by the return buckets of the tramway that brings up plaster rock from the crushing plant.

At the plaster mixing department the ground stucco is mixed with hair or fibre and retarder in Broughton mixers. Ton batches are made and every other batch is sampled for testing. The mixed plaster is packed by Bates valve bag packers and wheeled by trucks to railroad cars or to the warehouse.

Plaster board is made on a machine which was built some years ago from design made by one of the company's engineers. It is a belt machine about 300 ft. long. The paper and mixed plaster go onto a belt and pass under squeeze rolls in the usual way. The travel is slow to permit partial setting before the saws are reached. There are three saws at about the center of the machine, a cut off saw working in the usual diagonal slot, and two trimming saws for trimming the edges.

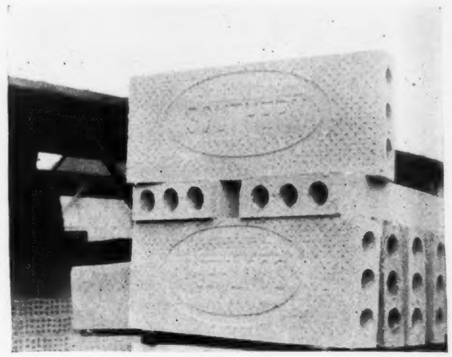
After passing the saws the boards go over a short course of live rolls which spreads them sufficiently so they can be picked off conveniently and then pass to a second belt. This belt is long enough so that setting is practically complete by the time the end is reached. The boards are picked off by one man, hung in clips by another and then pushed into the dryer over a mono-rail system.

The dryer at this plant is a straight chamber about 300 ft. long. The boards enter at one end and leave at the other through folding doors. Heat is brought in through ducts under the floor which has openings at several points along the chamber. Thermometers in the chamber show that it is kept at such an even temperature that the boards may be kept hot enough to dry quickly without danger of recalcination.

Heat is supplied from a furnace in which coke is burned as fuel. The hot gases are drawn out by a fan and sent through the ducts under the floor of the dryer. Regulation of heat is by the admission of cold air and by regulating the fire. There is no circulation of the hot gases.

At the block plant all the molding is by hand work but the work is so well arranged and systematized that it is performed quickly and is not very laborious. The molds are laid out on tables above which is a circular track from which a can hangs by a bail so that the contents may be poured from it easily. The mixer is on an upper floor and the can is filled from the mixer through a gate in the floor. The mixture of stucco and shavings brought from the plaster plant is mixed with a measured quantity of water.

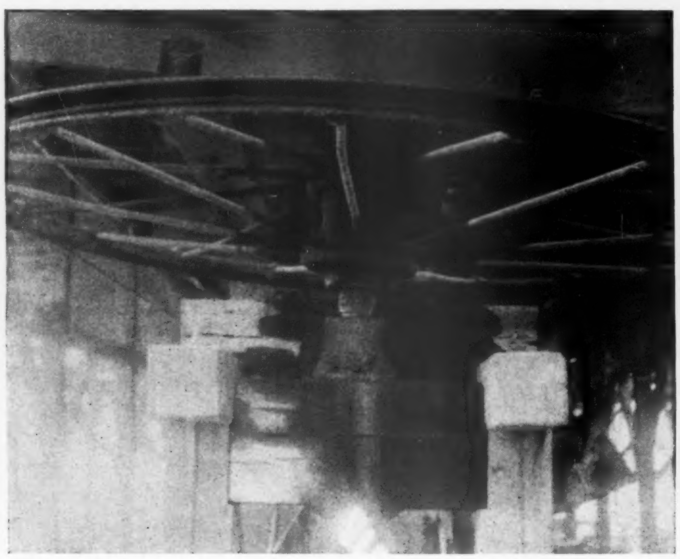
The molder fills the can and pours it into the mold and trowels the block smooth at



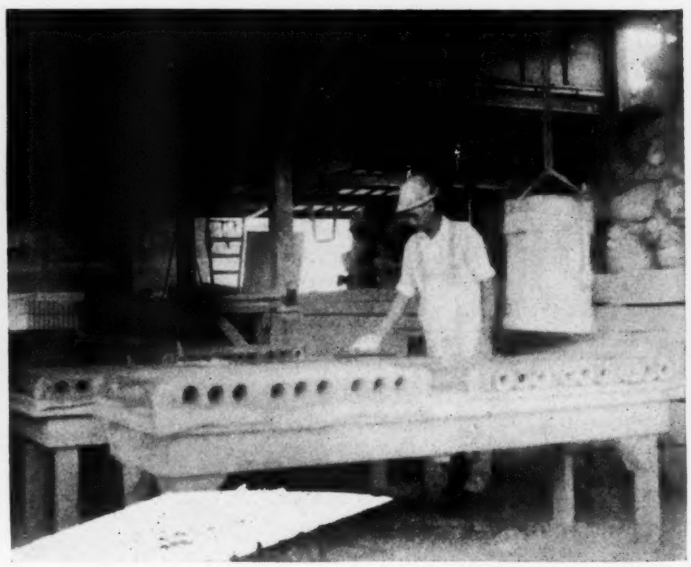
Type of gypsum block produced

the proper stage of setting. The core pins are removed and the top surface brushed to roughen it just before setting is complete. Another man takes the blocks away. The operation is timed so that the molder may comfortably pass from one part of the work to another without delay, giving a steady output without too much exertion.

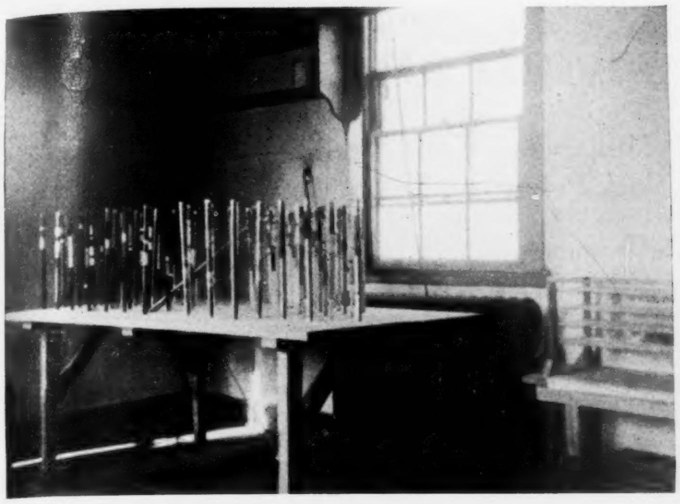
Blocks are cured in the open air and then removed to a shed where they are held for shipment, or stored in the yard. They are carefully piled with spacing pieces and blocks held in the open air for two years



Circular track over the molding cables. Cans filled with plaster are suspended from the track by a bail



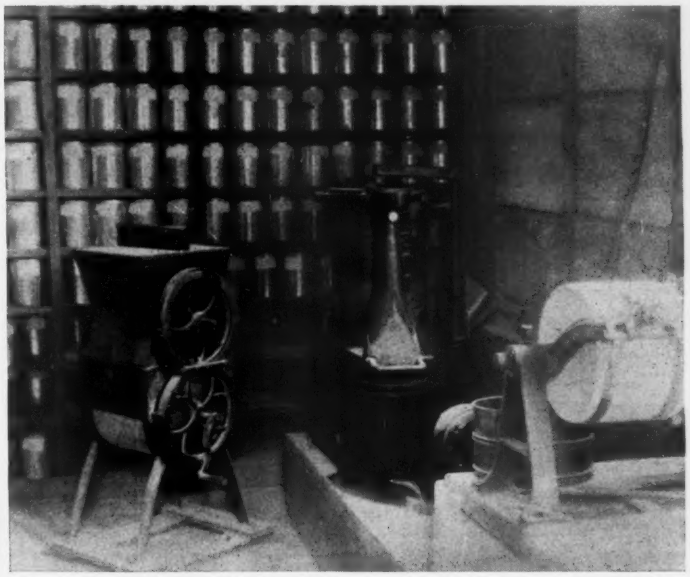
Molding table. The required amount of plaster is poured from the can to the molds and troweled smooth



Mine model on which all the different strata of the deposit are shown. Each peg represents a drill hole

A section of the well equipped laboratory where all physical and chemical testing of materials and products is carried out

D. W. Cramer, head of the laboratory, working on a physical test



Corner of the research laboratory showing grinding equipment

for testing show no deterioration.

The consistency of the mix, the percentage of shavings used and the curing are all the result of a study to determine the proportions and conditions that would insure a good, strong block.

The laboratories of the company are in well-lighted rooms and equipped for making all the necessary physical and chemical tests. Some research work is carried on as well. For this there is a small crusher, a Hunter sifter and mixed, a Ro-tap screening machine and a porcelain ball mill. There is also a Fairbanks testing machine for testing briquets. The chemical laboratory has the usual equipment for analysis.

Laboratory building where all tests are carried out

The laboratory is in charge of D. W. Cramer, who is a mining engineer with a good deal of experience in mining and metallurgy in various parts of the world. He is also in charge of the calcining plant and the making of plaster, plaster board and tile. He has two assistants in the laboratory.

The company prospects its ground thoroughly by diamond drilling, the work being carried on both from the surface and from underground workings. This drilling is done by contract with the Southern Drilling Co. B. A. Chappel is manager at North Holston. The drilling record is kept on a series of pegs, each representing a drill hole, on which different colors represent the character and depth of each stratum through which the drill passes. This is shown above on this page.

Dr. Frank A. Wilder is president of the company and Albert W. Ristine is vice-president. Charles H. Ewing is secretary and treasurer. Dr. Wilder was formerly state geologist of Iowa and is one of the foremost authorities on the geology of gypsum deposits.

J. W. Austin, mine superintendent

Charles Warner—The Man and His Work

The First of a Series of Interviews with the Outstanding Men in the Rock Products Industry

By Leon I. Thomas
Industrial Journalist and Author, Chicago, Ill.

GOOD-BYES had been said and my hand was on the knob of Charles Warner's office door. "But now just one thing about this—" he said, by way of calling me back. "Ah," I thought, "here it comes. Now appears the fly in the ointment." That nightmare of all interviewers, where an important man has said some very worthwhile things and then at the last minute spoils it all by saying, "But you must not quote me on this or that or that."

Mr. Warner didn't say that at all, but what he did call me back for was to remind me most courteously that he had Quaker blood in his veins and that modesty was therefore in order in anything I might write of him. Seemingly the thought had come over him as soon as he ceased talking that what had been an enthusiasm of interest in his subject might by readers be interpreted as a lack of modesty.

That trait of modesty seems to be a characteristic of Mr. Warner, no more strongly brought out at any time during our talk than when he showed a lack of sympathy for one-man organizations. "After all," he continued, "policies come from others in an organization besides the head of it. Some subordinate may give the head of a business an idea and then the chief executive mulls it over and in due course weaves it into the policies of his company."

Rather a modest point of view for the man who has played such a large part in the development of, and who now heads, an organization of the size and scope of the Charles Warner Co., and its affiliated company, the American Lime and Stone Co., Bellefonte, Penn. — the whole being known as the Warner-American organization. Sixty great floating units—dredges, tugs and barges—are now operated in the company service, producing and delivering sand and gravel for use in the construction of dwelling houses, of highways and of great industrial buildings and deep-set pier and bridge foundations. Then there is the operation of vast limestone quarries and lime kilns in eastern and central Pennsylvania. Thousands of tons of the Warner lime products are today distributed over a wide area for use in building and farming and in the production of paper, steel, glass, leather, soap and many other manufacturing and chemical industries. And a building supply business in Miami, Fla., in conjunction with rock and sand dredging operations on the coral rock bottom of Biscayne Bay in Miami harbor, which supply these products wholesale to the other dealers in the Miami district, as well as to their own retail department, is another enterprise headed by Mr. Warner.

An Historical Background

Just as a background against which to picture Mr. Warner and his enterprises it is

worth knowing that the Charles Warner Co. had its beginning as a business in 1794 and, incidentally, has occupied continuously the same location in Wilmington since that time. It is also interesting to know that the chronology of the old Warner family business has been a constant part of Delaware history. For instance, the Warner family ran the first sailing packets on the Delaware River, then operated the first steam packets over the same route; it was the first to bring anthracite coal into Delaware; it was the first to manufacture ice in Delaware; it was the first to have a typewriter in the state, and the first to use a telephone in Delaware business history. Certainly a long record of progressiveness.

As the business expanded beyond the packet line stage, it took on warehousing, an ice business, retail coal, and building materials. Of late years, however, concentration has been in order so that now only lime, sand and gravel remain in the Charles Warner Co. proper. It is true that in Wilmington a wharf and building material business is carried on, but this is kept purely for sentimental reasons.

The Value of Business Hunches?

Having been told that Mr. Warner was of that type of business executive who plans his moves with the care characterized by a chess player, as contrasted with the stage conception, which has its captain of industry hero arrive at snap decisions, I asked, "What about the value of so-called hunches in business?" The answers to that leading question were sufficient to show clearly the reason for the steady growth and sound advances which have been made by the Charles Warner enterprises.

"The numerous business opportunities that exist today," began Mr. Warner, "are best taken advantage of by a careful following of trends and tendencies—not by hunches. It is the long-time viewpoint, after all, that counts. You can sense something of these trends, for example, by following such reports as those of the Federal Reserve System, of prominent banks of the country, of the United States Department of Commerce, and so on. These are valuable tools in shaping for the modern business man, a general outlook of conditions existing all about him. Viewed solely with a close perspective, the picture may be misleading, but a general view obtained as I have outlined is vastly helpful.

"There are only three general courses of action a business man may choose to follow, and only one of these may be taken at any one time. He must (1) move ahead; (2) stand pat, or, (3) draw in. There is no other alternative nor can there be any successful straddling—any middle course.

"When general business conditions are fundamentally sound, other things being equal, the thing to do is to move ahead. And right now (summer of 1926), as I see it, general conditions are decidedly plus. So much for the watching of external conditions, but what of things within the closer perspective? These, too, should be taken into account. One must watch for opportunities within a business. One must size up local conditions. Such an analysis can come only through experience.

"So along with a following of reliable reports on general business conditions there need to be taken into account the detailed

reports of one's own business. If those too say 'Go ahead,' then go ahead it is.

"At the risk of appearing to inject too much of my own experience, I'll cite an example of how this line of reasoning works out. Four or five years ago it seemed to me that Philadelphia was beginning to outgrow the sleepy ways which, justly or unjustly, it has been proverbially supposed to have possessed. It had begun to forge ahead and, in my estimation, was destined to become a metropolitan center. It looked as if it would catch some of the overflows from centers near New York City.

Forecasting Business in Philadelphia District

Furthermore, concrete was more and more coming to be a factor in construction—greater attention to fireproofing was partly forcing this. So was the scarcity of lumber. Now concrete calls for sand and gravel. Since that is our business, we stepped into this section, but not without a parallel consideration of general countrywide business conditions. While all of the local conditions might have been as favorable as above outlined, still it would not have been wise to go ahead in this section if general financial conditions were not sound to go with it.

"As to whether or not the move was a wise one under the circumstances, I can only say that six years ago we did a business of 100,000 tons a year. Now we do 2,000,000, and the market takes it.

"Now, in answer to your question at the outset, perhaps you would call the above decision the result of a hunch. I don't think so. I believe it comes about simply as a combination of past experience, a knowledge of the business and an understanding of general countrywide financial conditions.

"In my stressing the value of a knowledge of general business conditions, I don't want to mislead anyone into the thought that I undervalue a close touch with local conditions. In fact, the man who has lived in a certain locality and knows it thoroughly has every advantage over the individual who tries to enter a territory entirely new to him. In my own business, for example, I wouldn't think of going into this field in Chicago—I don't know the conditions there at all thoroughly.

"Why then, you may well ask me, did you go into the business in Miami, Fla.? The answer is that I have been going there for years on vacation trips. I watched conditions there for six or seven years before I was convinced that the time had arrived for entry into business there. We finally went into Florida three years ago.

"Then, too, I believed that deep water terminals were the keys to the situation in Florida. Perhaps I was led to this viewpoint because I had been a member of the board of harbor commissioners of Wilmington, Del. The knowledge thus gained may have helped me. Anyhow, our experience in Florida last winter showed that we were correct in this.

"It has always been a pet idea of mine that the more a business man can broaden his experience, the better prepared he is to take advantage of his opportunities. The average business man, whether he realizes it at the time or not, actually utilizes all of his past experience.

"A specific experience of 10 or 15 years' standing may suddenly find direct application. You never can tell when it will come into play.

The Value of Broad Experience

"If business judgment has at its root an accumulation of experience, isn't it reasonable to suppose that the larger aggregate of the pooled experience of several men will yield safer judgments in the long run? I believe so, and therefore am of the opinion that it is generally the composite view of three or four men that forms the best method of getting at important decisions.

"But in order to get at all angles of a problem, by this method, it is best to have represented in the group both the aggressive and the careful types. And yet I don't believe the group should contain extremes of these two types, the radical on the one hand and the standpatter on the other.

"So it is I say that, except where outstanding geniuses are involved, the composite opinion is the best. And when I say this I am not unmindful of the many evils that beset committee action. The idea should not be carried to such an extreme that it is felt that nothing can be done without a conference. But so long as that is guarded against—so long as only reasonable conferences are adhered to—they form, in my opinion, the safest course to follow, for only in that way can you get a cross-section of the best thought in your organization. Conferences are undoubtedly useful if used in moderation."

And then, as a sort of aside, Mr. Warner made a statement which seemed to me to be characteristic of the man. He had just said, "If used in moderation," and he seemed to be pondering these words, and then added, "And isn't that so with a good many things? Sometimes extremes are necessary, but extremes don't fit the average case; moderation does." In that quiet aside, I felt sure, lay much of the philosophy that guides the Charles Warner enterprises. Expanded, this philosophy seemed to be this: Having a thorough knowledge of all the facts and acting upon them with a constructive moderation makes for steady growth and ever-increasing success. It was such a pleasing contrast with the condition you often see in present-day business where there is a feverish darting about hither and yon like a Fourth of July pinwheel which has broken loose from its pivot.

Relations With Employes

In his relations with labor you see many evidences of Mr. Warner's desire for moderation, for while all the recent developments in the handling of employes seem to have had consideration, yet there is no indulging in the fads which spring up so easily in this phase of management.

"We simply try to make the work safe, comfortable and profitable to the employes," said Mr. Warner, "and in doing so we keep strictly away from the paternalistic or anything that seems to smack of the paternalistic. We have not standardized our employe-employer activities. Those at certain plants may be peculiarly suited to local conditions at those plants and not at all applicable to others.

"Personal touch between employer and employe is vastly more valuable than any amount of highly-organized mechanical schemes for obtaining good relations. What is far more important, the head of a company should make himself accessible to all his men so far as is possible."

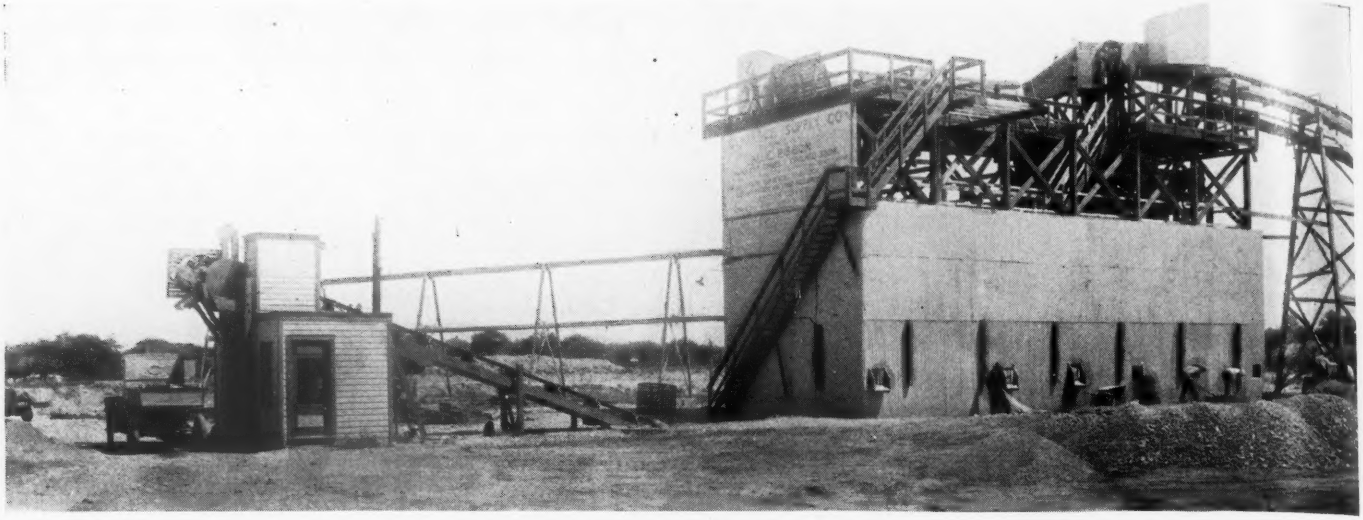
When I asked Mr. Warner just how a man with a grievance, at the bottom of the ranks, went about it to get his ear I opened up a very interesting managerial method on the one hand and an extremely enlightening view of Mr. Warner's executive ability on the other.

"Our suggestion system helps in this respect," he said, "but so do letters which employes write me. Such letters are encouraged or at least invited through our house organ. Surely the men sign them," he replied, the latter in answer to the question I put him. "Some of the causes for complaint turn out to be grudges; others result from just a natural incompatibility of temperament, in which latter case nothing but a transfer to another department will cure.

Letters Serve as a By-Pass and a Safety Valve

"I know that letters of this sort sometimes constitute a sort of detour around superiors, and going over the heads of superiors should be frowned upon except in abnormal conditions. But under unusual circumstances it does provide a sort of by-pass which serves as a safety valve. If all the supervisory executives in an organization know that there is a regularly authorized channel through which the head of a business may receive letters of serious complaint (and they generally have been serious, at least in the eyes of the employe, before he will write and sign a letter about it), it helps make for good management. Foremen will not be too monarchical, too high-handed. It seems to me to be wise to have foremen, superintendents and managers clothed with 99% jurisdiction in their departments, but not 100%. That lacking 1% is the balance wheel that makes things move more equitably and fairly for all concerned."

Perhaps Mr. Warner's quiet modesty best expresses itself, at least in its practical effect in this phrase of his, "The best monument to the head of a business is an organization that can run if its head can step out and everything goes on just the same." Incidentally, is it not a test of that man's constructive executive ability?



Storage bin and weighing platform at new sand and gravel plant of the Clarence Supply Co., Clarence, N. Y.

Compact Sand and Gravel Plant in Upper New York

Clarence Supply Co. Produces Over 1500 Tons Daily from a Simple Plant at Clarence, N. Y.

THE new sand and gravel plant of the Clarence Supply Co. was put into operation in September, 1925, and has been in constant production since. The location is on a 400-acre gravel deposit about 12 miles from Buffalo, N. Y., on the main line of the West Shore railroad and along the main highway between Rochester and Buffalo.

The deposit worked averages 50 ft. in depth and is overlaid with about 1½ to 2 ft. of soil and dirt. This is removed at the present time by a steam shovel. The underlying material consists of about 60% sand and 40% gravel. The sand runs about 10% mason sand and the balance concrete material. The gravel separates as follows: Pea gravel, 10%, ¾ in., 10% and 20% of 1½ to 2½ in. approximately.

The bank material is removed from the pit by a steam shovel which dumps on a bar grizzly set over a hopper box feeding a belt conveyor. The grizzly is set at about 4 in. clear opening. The material then passes along the conveyor belt to the screening plant where the different sizes are made and dropped into loading bins. The conveyor extends back about 300 ft. into the pit. In working the deposit the operators struck water after going down 25 ft. and as this appears to be a water level, a dredging system may be installed in the future.

The plant is a well designed and compact operation. The screen building and bins are entirely enclosed with sheet steel siding. Truck loading is accomplished in two ways: The truck can be backed up against the bin

The excavated material is passed onto the bar grizzly located over a hopper feeding a conveyor belt and is carried 300 ft. to the washing and screening plant

holding the particular size desired and filled or it can be loaded on the scale. For scale loading the material passes through bin gates onto a conveyor belt running in a tunnel under the bins. The belt carries the material to a point over the scale where it is spouted into the truck standing on the platform scale.

Taking into consideration that the plant did not go into operation until the season was almost at an end, the Clarence company is quite satisfied with the amount of business done and are contemplating the addition of another unit of the same capacity; that is, 1500 tons per 10 hr. day. Arrangements in the original plan allowed for this future increase of capacity without disturbing the present layout. All machinery was furnished by the Link-Belt Co., Chicago, and the Smith Engineering Works, Milwaukee, Wis.

Offices of the Clarence Supply Co. are maintained in Clarence, N. Y. M. P. Ryley is the owner of the company.

The Right Sand for Every Job*

Why the Sand Producer Must Be a "Sand Specialist"

THE plasterer thinks of sand in terms of his particular requirements; the concrete man thinks of it in relation to his own needs, and so on. Every user of sand for different purposes has his own needs in view when considering sand. The modern sand producer not only is familiar with the requirements of each class of sand user, but is able to furnish each with a certain kind and grade of sand for his particular use—whatever that use may be. Hence he is a "sand specialist." This is the position of the Stewart Sand Co. of Kansas City, Mo.

The accompanying photographs of the various kinds of Stewart's classified sand, taken of four actual sands as produced in the company's plants, and magnified five times, show some of the distinctions between the kinds of sands used by various workmen for various purposes.

Fig. 1—Classified concrete sand (Magnified 5 times)

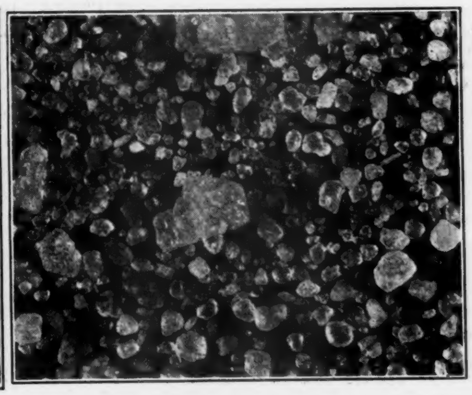


Fig. 2—Classified plaster sand (Magnified 5 times)

Fig. 1 shows a general building sand which is particularly adapted to concrete work, owing to its coarseness. Other conditions being equal, concrete made with coarse sand is cheaper than that made with fine sand, as there being less area of sand grain surface, it takes less cement to thoroughly coat the grains.

On the other hand, the plasterer desires a coarse sand containing more fines than does the concrete man. This is so that he will have a smoother plaster that will work easier under his trowel.

Fig. 2 shows such a sand. Note the even grading. The sand shown in Figs. 1 and 2 are standard sands as they come from the Stewart Sand Co. classifiers.

In Fig. 3 is shown filter sand like that furnished by the Stewart company for the filters of the new $11,000,000 water plant of Kansas City, Mo. This is a "manufactured" sand and undergoes an additional screening and classifying in order to meet the special specifications. Note the uniform size.

A good classified sand is never contaminated by quicksand. This renders it particularly desirable for use as a filler in asphalt for street paving, as the "fines" play a necessary part in preventing the sheet asphalt from "rolling" under the impact of traffic.

Fig. 4 shows a sand produced by the Stewart company for mixing with a coarser product to make a composite sand suitable for good asphalt work.

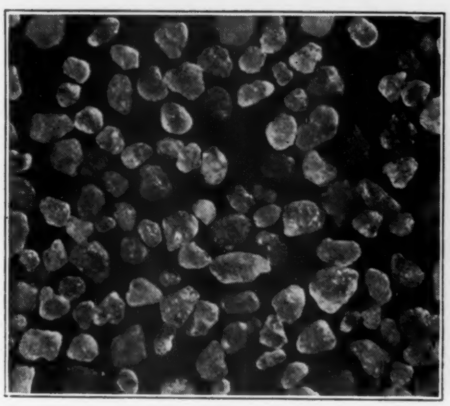


Fig. 3—Classified filter sand (Magnified 5 times)

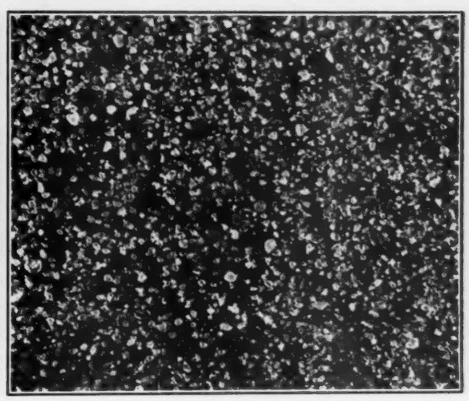


Fig. 4—Classified asphalt sand (Magnified 5 times)

*Reprinted by special permission from the January, 1927, issue of *Better Building*, published by the Stewart Sand Co., Kansas City, Mo.

Second Annual Southwest Road Show at Wichita, Kansas

THE second annual Southwest road show and school will be held at Wichita, Kan., on February 22 to 25, inclusive. Nine of the principal states of the Southwest in which there are said to be more than 85,000 miles of road and 80,000 miles of state highway are covered by the show. These states have approximately $150,000,000 available for road construction and maintenance in 1927. In addition, a comprehensive building program is looked for in the next year in this territory.

Interesting exhibits of road machinery and equipment have been arranged for. The partial program of the road school offers the following features: "Highway Location and Traffic"; "Traffic Studies and Finance"; "Road Design and Construction"; "Maintenance," and "Production of Sand, Gravel, Crushed Stone." Motion pictures on pertinent subjects of interest to highway engineers, contractors and others will be shown. The Bureau of Public Roads and the American Association of State Highway Officials will take an active part in the exposition. Speakers of national repute in highway work have been secured for the program.

The show is favorably located in the Southwest and is easily accessible. A good attendance of interested people in all lines of road work is expected. All the construction and road equipment purchasers have been circularized and invited through an extensive advertising campaign. Exhibits and space reservations may be arranged for upon application to F. G. Wieland, general manager in charge of the exposition, Exposition Bldg., Wichita, Kan.

Plasticity of Finishing Limes*

Effects of Various Conditions of Calcination and Hydration on Plastic Properties of the Hydrated Limes

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In order that hydrated lime may be classed as a plastic "finishing lime," it must so react with water as to produce a putty which spreads easily under the trowel without sticking or pulling. Plastic lime makes possible the application of an even, smooth "white coat" without undue labor on the part of the plasterer. Only a very few hydrated limes will yield plastic putties when they are soaked in water. It is of interest, therefore, to determine the effect of various conditions of calcination and hydration upon the plastic properties of the hydrated limes.

Calcination may be made at too low a temperature as well as at too high a temperature. Under laboratory conditions, a temperature of 1050 deg. to 1150 deg. C. has been found most satisfactory for the production of plastic limes.

The plastic properties of hydrated limes that are produced from stones treated with solutions of alkali metal salts, particularly sodium chloride, before burning, are much more satisfactory than the properties of limes made from untreated stones. The sodium chloride treatment renders the quicklime softer and much more inactive. The rate of its hydration may, therefore, be regulated by the proper addition of salt to the stone.

Hydration of lime in steam, treatment of the hydrated lime with steam, drying plastic putties, and hydration of the quicklime with relatively large amounts of water result in decreased plasticity.

It is believed that plasticity is due to hydration, particularly hydration of magnesia, which takes place during the soaking of the lime in water. Evidence in support of this view is found in the results of experiments which deal with the losses of various plastic and non-plastic hydrates when heated to certain temperatures and the gain in weight which these same limes undergo when they are allowed to stand in contact with water.

It is unfortunate that the term "plasticity" has been so generally used in the description of the working qualities of putties made by soaking limes in water previous to their use as finish coats of plaster. It has long been used in a very definite sense in the description of clays and similar materials. It seems desirable that the definition of plasticity discussed by Bancroft[2] be retained to describe that property which permits certain substances to be molded under pressure, and that in the case of lime putties we should substitute for plasticity an exact description of the properties of the plasters which either do or do not make them desirable finishing lime putties. For various reasons, however, it seems best to use the term "plasticity" in this paper as it is used today in the lime industry.

Emley[3] has defined a plastic lime putty as one in which the internal friction is not sufficiently great to make it "sticky" or so low as to make it "sandy." Plastic putty does not dry out quickly when it is applied to an absorbent surface. It does not stick to the trowel nor does it drag or pull in resistance to the force which the plasterer exerts in spreading it, but may be spread evenly and smoothly without very great internal friction or resistance to forces that tend to deform it.

The lime industry is without much definite information on the subject of plasticity. The plastic finishing limes are produced from dolomites or highly magnesian limestones of northwestern Ohio. Other limestones, although they have almost exactly the same chemical composition and in some cases even belong to the same geological formations, the Niagara, are not calcined to give limes that are suitable for this purpose. No high calcium stone is at present used to produce a dry hydrated lime that is suitable for finish purposes. All quicklimes, however, yield fairly plastic putties when they are slaked with sufficient water to produce the putty without the formation of the intermediate dry form. No dry hydrate yields a plastic putty immediately after it is mixed with water. Plasticity increases with time of soaking.

The purpose of this investigation was to determine the relation between various properties of quicklimes and their hydrates and the plasticity or working qualities of the plaster putties made by soaking the dry hydrated limes in water, and to deduce probable theories to account for the difference in the plastic properties of such putties.

Experimental

The list of dolomites studied includes stones from the quarries of various manufacturers of plastic and non-plastic hydrated limes. Commercial quicklimes and hydrates were also generously supplied by the manufacturers. Laboratory samples of quicklimes were obtained by burning the stones in crucibles heated by gas flames or in electric furnaces made by wrapping alundum tubes with resistance wire. Temperatures were read by means of thermocouples. Quicklimes were hydrated by adding definite amounts of water to weighed samples of limes and stirring during the course of the reaction. Other methods of hydration will be described under the headings of those phases of the work which they were employed. Plasticities were determined, unless otherwise stated, on the Emley plasticimeter.[4] Lime putties giving a plasticity figure of 200 or more on this instrument are considered suitable for finish plaster.

The limestones and limes have been assigned numbers and they will be referred to in the discussion by mention of the numbers. Nos. 1 to 5 have been assigned to stones that are used in the manufacture of commercially plastic hydrates or have been found in the course of laboratory investigations to be more or less readily converted into plastic limes. The other limes, Nos. 6 to 9, are not plastic.

Rate of Settling

Recent investigators, Holmes, Fink and Mathers,[5] have made an exhaustive study of the rates of settling of quicklimes and hydrated limes in water. Their data show, however, very little, if any, relationship between the rate of settling of the hydrates and the plasticity of the putties. These results have, for the most part, been verified and will not be given here. It has been found, however, that many plastic hydrates do not settle more slowly than the non-plastic ones; in fact, some were found to settle more rapidly when they were first mixed with water (10 grams lime to 100 cc. water) in a graduated cylinder and the volume of the settled mass read after five minutes. Upon standing in contact with water for several hours, the rate of settling was greatly decreased in the case of the plastic hydrates. For example, two non-plastic limes were found to settle to volumes of 91 and 72 cc., respectively, in five minutes, while in the same

*Reprinted from *Industrial and Engineering Chemistry*, **19**, 88-93.

[2] "Applied Colloid Chemistry," p. 154, McGraw-Hill Book Co. Inc., 1921.

[3] *J. Am. Ceram. Soc.*, **19**, 523 (1917).

[4] "Measurement of Plasticity of Mortars and Plasters," *Bur. Standards, Tech. Paper* 169, 16 (1920).

[5] *Chem. Met. Eng.*, **27**, 1212 (1922).

period of time, two very plastic limes settled to volumes of 25 and 27 cc. After standing in contact with water for 18 hours, the volume to which each settled in five minutes was again noted. These volumes for the two plastic hydrates were 87 and 82 cc., respectively, while the settled volumes of the non-plastic limes were 90 and 75. The final volumes, after settling 72 hours, of two non-plastic limes were 44 and 45 cc., while the volumes of two plastic limes, settled under the same conditions, were each 49 cc. These are typical results. It was noted that, in general, the final volumes, after the limes were allowed to remain in contact with water for some time, were greater for the plastic hydrates. It is concluded, therefore, that plastic hydrates are not necessarily the most finely divided. Dispersion, however, does seem to take place in a number of cases to a marked extent when such limes are allowed to remain in water suspension.

Plasticity of Dried Pastes Upon Resoaking

Since most quicklimes yield plastic putties when the putty is produced directly from the quicklime, although the dry hydrate may not be plastic, it was of interest to determine the effect of drying plastic putties at various temperatures. The putties were made by mixing dry hydrated limes with water and also by slaking quicklimes with excess water. They were dried, and the dry materials were crushed and resoaked. The results (Table I) indicate that the drying of a plastic putty results in a loss of plasticity, and such dried and resoaked pastes are less plastic than putties made from the dry hydrates of the same limes. It will be noted that plasticity was increased in some cases were the putties were dried at temperatures near 325 deg. C. For example, a plastic sample was soaked and dried at this temperature, after which the resoaked lime was found to give a plasticity value of 274 compared to 215 for the originally soaked hydrate. Sugar was added to some of the putties to cause the dried lime to be more easily crushed. When it was added in the amounts indicated in Table I, it had only slightly harmful effects on plasticity. Pastes containing sugar are too liquid and sticky for plastic materials. The addition of hydrochloric acid to the water used in forming the putties resulted in increased plasticity. In one such case the plasticity of the dried and resoaked lime was 225 compared to the figure 90 for the plasticity of the putty made from the commercial dry hydrate.

It is believed that the mere drying of the hydrate and probably the conditions under which it has been produced in the dry form cause decreased plasticity. Such differences as are noted may be due to differences in structure or state of aggregation of the lime particles, or to chemical differences in the hydrates produced under the different conditions. It seems likely, since pastes that are dried at 325 deg. C. are plastic upon resoaking, that any hydrate which is dehydrated during the drying process tends to slake during soaking and thus allows the paste again to become plastic. It is believed that the magnesia is the constituent of the hydrate which is essentially involved in this reaction. Johnston[6] has measured the dissociation pressures of calcium and magnesium hydroxides and has found that at 325 deg. C. the latter will be completely dissociated while the former will be but little changed. The writers have obtained results in dehydration of dry hydrated limes that agree with the results of Johnston. Pure magnesium hydroxide and a high calcium hydrate were heated in an electric furnace at a temperature of 325 deg. C. until the weights were constant or approximately so. The losses in weight were 28.4% and 0.1% of the original samples, respectively.

Plasticity of Limes Hydrated in Steam

Limes that are treated with steam are probably subjected to comparatively high temperatures during hydration and are probably more or less completely hydrated. At least greater opportunity has existed during the reaction for complete combination with water than exists when the quicklime is treated with a small quantity of cold water much of which is expelled by the heat generated by the reaction. Magnesia as well as calcium oxide may be completely slaked in steam.

Quicklimes were hydrated to dry hydrates in steam by placing samples above water which was brought to or near to the boiling temperature. Samples of the same limes were hydrated in the usual manner by adding cold water to the quicklimes. The hydrates formed in steam were decidedly less plastic. The results, given in Table II, show how pronounced this difference in plasticities was found to be. Greater temperatures were developed in some cases than in others. During the reaction of the very active quicklimes, such as No. 7, the temperature became sufficiently high to cause paper labels on the vessels containing the samples to char and burn.

TABLE II—PLASTICITY OF LIMES HYDRATED IN STEAM

Lime-stone No.	Quicklime temp. of burning deg. C.	Method of hydration	Plasticity No.
T*4	1100	With water to dry hydrate	315
T 4	1100	With steam	73
5	1100	With water to dry hydrate	405
5	1100	With steam	88
7	Commercial	With water to dry hydrate	216
7	Commercial	With steam	80
T 5	1100	With water to dry hydrate	300
T 5	1100	With steam	130

*Stone dipped in 10% sodium chloride before burning.

The more or less incomplete hydration that occurs when quicklime is treated with limited quantities of water may allow hydration to proceed during soaking. It is extremely unlikely that much of the magnesia reacts with water during the brief time that the lime is allowed to remain in the hydrator. This magnesia, however, is capable of hydrating even though it has been heated to temperatures in excess of 1000 deg. C.[7] Hydroxides that are formed during the period of soaking, since they have not been dried, would be expected to result in the formation of more plastic putties than are formed from limes that have been slaked in steam in which cases suitable conditions have existed for the complete reaction of all oxides with water. The structure of the hydrates made in steam may be such, also, that they do not absorb

[6] *Z. physik. Chem.*, **62**, 336 (1908).

[7] Campbell, *Industrial and Engineering Chemistry*, 1, 665 (1909).

TABLE I—EFFECT OF DRYING PLASTIC LIME PUTTIES

Quick-lime No.*	Method of hydration and treatment before drying	Drying temperature and treatment after drying	Plasticity No. Dried hydrate	Plasticity No. Commercial hydrate
2	To wet paste	150 deg. C., soaked	170	275
9	To wet paste	325 deg. C., soaked	199	90
	Hydrated lime from U. S. Bur. Stds., soaked	325 deg. C., soaked	274	215
	No. 3 commercial hydrate, soaked	500 deg. C., slaked in steam, dried at 300 deg. C., soaked	127	320
	No. 3 commercial hydrate, soaked	Treated with steam under pressure, dried at 300 deg. C., soaked	175	320
	No. 3 commercial hydrate, soaked	500 deg. C., steam-slaked, dried at 300 deg. C., soaked	45	320
	No. 9 commercial hydrate, soaked	325 deg. C., soaked	156	90
	No. 4 commercial hydrate, soaked	500 deg. C., steam-slaked, dried at 300 deg. C., soaked	32	55
2	To wet paste with 300 g. water, 1 g. sugar for 150 g. lime	200 deg. C., soaked	180	275
2	As above, but with 500 g. water	200 deg. C., soaked	170	275
9	As above with 300 g. water	200 deg. C., soaked	90	90
9	To wet paste with 300 g. water, 5 cc. concd. HCl for 150 g. lime	200 deg. C., soaked	284	90
9	As above but with 500 g. water	200 deg. C., soaked	225	90
	No. 3 commercial hydrate, water added and heated under pressure at 200 deg. C.	Not dried before soaking	330	320
	No. 3 commercial hydrate, treated as above	300 deg. C., soaked	170	320
5	To moist powder	Not dried before soaking	430	150
5	As above	Dried before soaking	100	150

*All quicklimes are commercial samples.

water as readily as those made under other conditions, and consequently do not produce as plastic putties.

Plasticity of Steam-Treated Hydrates

The treatment of commercial and laboratory samples of hydrated limes with steam at atmospheric and higher pressures resulted in a decrease of plastic properties. This effect is probably due, as suggested above, to complete hydration of all oxides in the lime or to such changes in the structure of the hydrates as have already been suggested.

Commercial hydrate No. 3 was placed in a pressure bottle with 12% of its weight of water and heated at 200 deg. to 250 deg. C. for several hours. The plasticity number of this excellent finishing lime was reduced to 170 by this treatment. The plasticity was reduced to a value of 180 at a temperature of 100 deg. to 125 deg. C. When the latter experiment was repeated with 66% water, the plasticity number of the treated lime was only 63. The treated limes were carefully dried before soaking.

A number of attempts were made during the earlier phases of the investigation to increase the plasticity of nonplastic limes by similar treatments with steam. These results were all negative. It was found, however, that the plasticity was not greatly affected by the steam treatment when the treated products were left wet after removal from the steam chamber and were not dried before soaking.

Three samples of commercial hydrates, one plastic and two nonplastic, were placed in air-tight containers with 10% their weight of water and allowed to remain untouched for one year. The plasticity of the nonplastic limes was not changed, but that of the plastic sample was reduced to a value of 65. This is, perhaps, of interest to those who have stored or who have contemplated the storage of hydrated lime under conditions which might allow it to undergo similar changes in the presence of water. The effect of the water in this case is probably similar to that of the steam in the experiments discussed above.

Effect of Amount of Water Used in Hydration

Quicklimes were hydrated by adding different amounts of cold water to the powdered limes. The hydrates were screened and soaked. The results, which are given in Table III, indicate that a higher plasticity value is obtained by hydrating the quicklime with 25 to 30% of its weight of water than by using larger amounts.

It was found that plasticity was increased by adding the water in portions to very active limes. When the very active quicklime No. 7, for example, was hydrated by first adding 5%, cooling, and later adding 20 per cent its weight of water, this commercially non-plastic lime gave a hydrate with a plasticity number of 310. This experiment shows the importance of the rate of hydration upon the plastic properties of the product. If the activity of the quicklime is cut somewhat by adding a small quantity of water, the remainder of the lime may be so hydrated as to prevent the bad effects commonly known as "burning." The hydroxides that are formed and the oxides that remain in the dry product more readily react when mixed with water to produce a plastic putty than is the case when the ordinary method of hydration is carried out. The writers realize, of course, the difficulty attending the commercial application of this idea. There are fortunately, however, other methods of regulating the rate of hydration. These methods will be discussed later. It is desired, at this point, to emphasize the fact that there are reasons for believing that any condition which permits hydration to proceed during soaking increases the plasticity of the putty. That some reaction or change does occur when the lime is mixed with water can be proved by the testimony of lime manufacturers who have performed soaking tests on plastic and non-plastic limes. Although equal amounts of water may be added to equal weights of limes, the plastic samples are found to be stiffer after soaking, the lime "has taken up the water," and the putty possesses "body" and slips off the trowel without sticking. The non-plastic limes have not combined with the water, or, if they have combined with it, the resulting putty possesses different properties. Lime and water often seem to have separated into two layers. In other cases the pastes are sticky and possess but little "body" or plasticity in the true sense of the word. Such pastes slump badly when they are molded.

The writers feel that their experience warrants the conclusion that the use of an amount of water in the hydrators which is insufficient for the complete reaction is the most simple method of increasing plasticity. The amount of water required will not be the same for all limes, but will vary particularly with the conditions under which the stone was calcined. More water may be added to active limes, since more will be expelled by the heat generated in the brief period of reaction.

TABLE III—EFFECT OF AMOUNT OF WATER USED IN HYDRATING QUICKLIMES UPON PLASTICITY OF HYDRATED LIMES

Lime No.	Water Used in Hydration† Per cent	Plasticity No.
4 Com.	40	183
4 Com.	60	88
4 Com.	70	98
4 Lab.	30	390
4 Lab.	50	210
4 Lab.	60	130
4 Lab.	65	140
4 Lab.	70	98
T*7	40	460
T 7	50	390
5 Lab.	35	414
5 Lab.	40	405
7 Com.	25	250
7 Com.	40	216
7 Com.	15% water added, lime cooled, and 10% more water added	255
7 Com.	5% water added, lime cooled, and 20% more water added	310
5 Com.	25	450
5 Com.	30	300
5 Com.	40	157

*Stone dipped in 10% sodium chloride before burning.
†Based upon weight of lime.

Effect of Adding Substances to Water in Which Dry Hydrated Lime Is Soaked

Since it was believed that the production of magnesium hydroxide in the putty during soaking was helpful in developing plastic properties, non-plastic hydrates were soaked in 10% solutions of magnesium chloride. The effect upon the plasticity of the putties is shown by the following results:

Lime	Soaking Solution	Plasticity No.
Com'l calcium hydrate	Distilled water	30
Com'l calcium hydrate	10% $MgCl_2$	180
Com'l calcium hydrate	10% $MgCl_2$ and 10% NaOH	180
Com'l No. 4 hydrate	10% $MgCl_2$	175
Lab. calcium hydrate	10% $MgCl_2$	370

The laboratory sample of high calcium lime which is mentioned above gave a very plastic putty after soaking in a solution of magnesium chloride. This lime, after soaking only a few minutes, gave evidences of reaction. The paste stiffened very noticeably and more water had to be added to restore the desired mixture of lime and water. The product may have been the oxychloride of magnesium.

Other salts, and a few organic substances also, were dissolved in the water used for soaking the limes and their effect on plasticity was noted. Ammonium oxalate and manganese chloride gave the least plastic products, while magnesium sulphate, ammonium chloride, and sodium chloride gave increased plasticity, but the general effect was not so great in any case as in those putties produced by the use of solutions of magnesium chloride. Alcohol and glycerol reduced plasticity, while ether, benzene, acetone, toluene, and carbon tetrachloride were without significant effects. One-hundred-gram samples of the limes were first wet with the organic liquids and then soaked in water.

Properties of Limes Produced from Stones Treated with Sodium Chloride and Other Salts

During the course of numerous laboratory investigations dealing with the effect of traces of salts upon the properties of limes produced in their presence, it was found that traces of sodium chloride in the stone exerted a very significant influence upon the calcination of the dolomite and upon the properties of its products.[8] The effect, in general, was to produce a lime possessing some but not all the properties of an overburned quicklime. The sodium chloride was added to the stone either by soaking the piece of rock in a solution of known concentration before burning or by adding a definite amount of salt to the stone in the crucibles during the calcination. The products of the two methods were exactly the same. The quicklimes so produced were much softer than those otherwise made, the crushed lime was more smooth and very finely textured and, most significant of all,

[8] Mathers and Briscoe, U. S. Patent 1,588,253 (June 8, 1926.) Editor's Note: This patent was published in full in ROCK PRODUCTS, August 7, 1926.

hydrated very slowly. In fact, the rate of hydration of the quicklime can evidently be regulated by the addition of the proper amount of salt to the stone. The dry hydrated limes produced from these treated products were very voluminous and when soaked were found to be much more plastic than the limes that were obtained from untreated stones. The effect of salt upon dolomites from many localities and in hundreds of experiments was investigated. Representative results are given in Table IV.

TABLE IV—PLASTICITY OF LIMES PRODUCED FROM STONES TREATED WITH SODIUM CHLORIDE

Limestone No.	Treatment of Stone Before Burning	Temperature of Burning (Deg. Cent.)	Time for Hydration to Start Seconds	Plasticity No.
4	None	1000	2	145
4	Dipped in 1% NaCl solution	1000	15	254
4	Dipped in 2% NaCl solution	1000	30	180
4	Dipped in 30% NaCl solution	1000	120	140
4	Dipped in 30% NaCl solution	1100	Very slow	315
5	None	1100	2	414
5	Dipped in 30% NaCl solution	1000	180	90
5	Dipped in 30% NaCl solution	1100	120	410
5	Dipped in 5% NaCl solution	1000	30	415
7	None	1000	1 to 2	50 to 100
7	Dipped in 1% NaCl solution	1000	5	160
7	Dipped in 5% NaCl solution	1000	60	464
7	Dipped in 30% NaCl solution	1000	Very slow	Semi-plastic
6	None	1000	1 to 2	50 to 100
6	Dipped in 5% NaCl solution	1000	Slow	342
6	Dipped in 20% NaCl solution	1000	Slow	325

Very active quicklimes, such as No. 7, react with water with almost explosive violence. Such quicklimes, however, when produced from treated stones, are so inactive that they may be placed in the mouth for some time without the development of sufficient heat of reaction to be uncomfortable. The effect upon plasticity is believed to be obtained because of the retarded rate of hydration and the decreased activity which permits hydration to be carried out only so far as the major portion of the calcium oxide is concerned. During soaking more or less complete hydration results. In the case of the untreated limes the calcination must be made at such temperatures as will overburn the lime, in which cases the magnesia will never hydrate; or, if carried out at low temperatures, the lime will be so active that both oxides hydrate during the formation of the dry product with the bad effects of "burning" and the formation of hydroxides that are inactive toward water during soaking. In short, the writers believe that the treatment of the stone with sodium chloride before its calcination offers a means of controlling the rate of hydration and the extent to which the oxides in the quicklimes react with water during the production of the dry hydrate. These two factors are considered of extreme importance in the formation of a hydrated lime that will yield a plastic putty.

Other Alkali Halides Effective

All other alkali halides were found to be equally effective in the production of quicklimes of the desired properties. Attempts were made to produce soft, inactive quicklimes by burning stone No. 7 after dipping small pieces of it in 10% solutions of the following salts: Sodium acetate, ammonium acetate, manganese chloride, manganese nitrate, barium acetate, potassium carbonate, potassium sulfide, ammonium tartrate, ferric nitrate, aluminum nitrate, potassium nitrate, sodium borate, zinc chloride, lead nitrate, sodium carbonate, magnesium nitrate, ammonium carbonate, barium chloride, calcium chloride, strontium chloride, nickel chloride, and sodium silicate. The treatment with sodium and ammonium acetates gave soft quicklimes. All others were hard, but the activity was noticeably affected by the treatment with sodium and potassium salts, and limes so treated gave dry hydrates of increased plasticity.

In burning dolomites from the plastic district the writers often observed deposits of sodium chloride upon the lids of the crucibles in which the stones were calcined. Such deposits were not observed in the calcination of non-plastic limes. Although it seems that the relative amount of alkali metal rather than the amount of alkali salt in the stone is of importance in the determination of the value of the stone for plastic lime manufacture, it was decided to analyze the various stones for chloride, since the volatilization of sodium chloride was so noticeably different in the two classes of stones.

The results are given in Table V. It is significant that those stones which were found commercially or during laboratory investigations to be converted readily into plastic limes without treatment of any kind contained the greatest amount of chloride.

TABLE V—RELATION OF AMOUNT OF CHLORIDE IN STONE TO PLASTICITY OF HYDRATED LIME MADE FROM STONE

Limestone No.	Plasticity of Lime Made from Untreated Stone	Chloride Content of Stone Sample Per cent by wt.
7	Non-plastic	0.0205
10*	Plastic	0.1126
3*	Plastic	0.0723
11*	Unknown	0.0823
8*	Plastic	0.1205
4*	Fair plasticity	0.0617
5*	Plastic	0.1932
6	Non-plastic	0.0155
9	Non-plastic	0.0451

*These limestones belong to the same geological formations as the stones in the plastic area of Ohio. They are found either in plant practice or in laboratory investigations to give hydrated limes of at least satisfactory plastic properties without special treatment of the stone or quicklime.

Relation of Temperature of Burning to Plasticity of Hydrated Limes

The temperature at which quicklime is produced largely determines the hydrating properties of the lime, and the rate of hydration, in turn, seems to have an important influence upon properties of the hydrate. If the temperature of burning is extremely low, let us say below 1000 deg. C., the lime will be very active. Both calcium oxide and magnesia will hydrate when water is added. A high temperature may be attained during a part of the reaction with the attendant dangers to the product because of "burning" and the formation of sandy, crystalline material that will not soak to a plastic putty. If, on the other hand, the temperature of burning is quite high, let us say above 1200 deg. C., the lime may be overburned. During the hydration of such limes, the calcium oxide will probably completely hydrate, since it is difficult to deadburn it at such temperatures, but the magnesia will have been deadburned and will not combine with water during the formation of the dry hydrate, or during the soaking of the lime to form the plaster putty. There should, then, be an intermediate temperature at which quicklime may be burned to give upon hydration hydrates of maximum plasticity. This is exactly what the investigation has shown to be the case. It should be remembered, in examining the results given in Table VI, that laboratory conditions of burning, in which small pieces of stone were heated for short periods of time, cannot be directly compared with the operating conditions of the lime plant. General principles determined in the laboratory, however, can be carried over to the plant scale.

TABLE VI—PLASTICITY OF LIMES BURNED AT DIFFERENT TEMPERATURES

Lime No.	Temperature of Burning (Deg. Cent.)	Plasticity No.
4	1050	90
4	1090	150
4	1160	240
4	1205	210
4	1260	210
T*7	980	120
T 7	1025	90
T 7	1075	180
T 7	1100	285
T 7	1120	300
T 7	1140	300
T 7	1400	210
2	1025	94
2	1050	173
2	1075	174
2	1125	173
2	1200	164

*Stone dipped in 10% solution NaCl before burning.

The dolomites were burned at different temperatures for 2 hr. The quicklimes were hydrated with 30% their weight of water, and the dry hydrates were screened and soaked for 16 hr. The working qualities of the putties were tested by the Carson blotter test, and the plasticity numbers were determined with the Emley plasticimeter. The properties of the putties were also compared with the properties of the putties made from plastic finishing limes which give plasticity numbers of 275 to 350.

It was noted that the quicklimes produced at the low temperatures, near 1000 deg. C., were hard and the crushed lime was sandy. Such quicklimes hydrated very rapidly and the dry hydrates were coarse and somewhat crystalline, and remained so after soaking for several hours in water.

To test the effect of overburning, a soft, white, commercial quicklime was heated sev-

eral hours at a temperature of approximately 1150 deg. C. in a gas-fired pot furnace. The commercially hydrated lime is very plastic and is sold as finishing lime, but the hydrate produced from the quicklime that had been re-heated was decidedly non-plastic. The plasticity number was 112.

Dehydration of Hydrated Dolomitic Limes

It has already been shown that magnesium hydroxide dissociates at comparatively low temperatures. In the recording of the data in Table VIII it has not been the intention to claim that the complete loss in weight of the hydrate at 325 deg. C. is due to the dissociation of the magnesium hydroxide alone. Some of the loss may be due to the volatilization of adsorbed water, or so-called colloidal water, and small amounts of it may be due to the dissociation of calcium hydroxide. It is believed, however, that, in general, the losses at this temperature are measures of the extent to which the magnesia in the various samples of lime has lost the water with which it had reacted during the formation of the dry hydrate or during soaking as the case may be. Whatever the source of the water lost, the significant point is the relation of the amount lost to the plasticity of the lime.

It was found that the plastic hydrates gained considerably more weight upon soaking than did the non-plastic limes. This greater gain is due certainly to a greater extent of a reaction involving combination with water, and indicates the correctness of the theory explaining the plasticity of certain putties, namely, the change in properties resulting from hydration during the soaking of the dry hydrated lime. Plastic hydrates do not lose much weight until they have been allowed to stand in contact with water for several hours, while some non-plastic products show comparatively great losses when the dry limes are heated at 325 deg. C. Such losses are most probably due to the dissociation of magnesium hydroxide formed in the hydration of low-temperature quicklimes. In the case of other non-plastic limes, where no great losses before soaking and no gains in weight upon soaking were found, the quicklimes were probably overburned to the extent that the magnesia was rendered exceedingly inactive.

TABLE VII—GAIN IN WEIGHT OF PLASTIC AND NON-PLASTIC LIMES DURING SOAKING

Lime No.	Plasticity	Magnesia Hydrated During Soaking Per cent
T*4	Plastic	73.92
T 4	Plastic	75.92
4	Non-plastic	47.52
T 6	Plastic	74.59
6	Non-plastic	21.78
T 5	Plastic	100.00
2 Com.	Plastic	87.12
7 Com.	Non-plastic	19.14
4 Com.	Non-plastic	12.50
T 5	Plastic	73.26

*Stone dipped in 10% sodium chloride before burning.

To determine the gain in weight upon soaking, the dry hydrates were soaked for 16 hr., the putties were carefully dried at 120 deg. C., and the dried materials were weighed. In the determination of the loss in weight at 325 deg. C. the dry hydrates were first heated at 120 deg. C. to remove uncombined water and later heated at the higher temperature until the weight was reduced by an amount less than 0.1% the original weight during 1 hr. of heating.

In the tabulation of results in Tables VII, VIII, and IX the percentages of magnesia hydrated have been calculated on the basis that the losses at 325 deg. C. are due to the dehydration of magnesium hydroxide, and that the gains in weight upon soaking are due to the combination of magnesia with water. The assumption has also been made that the original samples of quicklimes contained 40% magnesium oxide and 60% calcium oxide, since the analyses of the various stones show them to have practically the same composition and to be typically dolomitic. This method of calculation is not, of course, strictly accurate, but has been employed because it very clearly demonstrates the diffierences in the two classes of limes.

TABLE VIII—DEHYDRATION OF HYDRATED DOLOMITIC LIMES

Lime No.	Plasticity	Magnesia Hydrated (Dry Hydrate) Per cent
T*4	Plastic	11.22
4	Non-plastic	14.52
6	Non-plastic	53.46
5	Semi-plastic	27.72
3 Com.	Plastic	13.26
T†4	Plastic	14.52
T 2	Plastic	3.76
T 2	Plastic	3.30
3 Com.	Plastic	3.30
T‡4	Plastic	8.24
T‡4	Plastic	9.36
4	Non-plastic	64.02
4	Non-plastic	62.04
1 Com.	Plastic	4.62
T 5	Plastic	5.28
4	Non-plastic	15.18
T§4	Plastic	3.30
9 Com.	Non-plastic	3.32
7 Com.	Non-plastic	6.60

*Stone dipped in 10% sodium chloride.
†Stone dipped in 1% sodium chloride.
‡Stone dipped in 2% sodium chloride.
§Stone dipped in 5% sodium chloride.

The non-plastic No. 6 hydrate was ignited. It had been produced from a very active quicklime. Its loss in weight upon ignition was 24% of the weight of the sample. This proves that some of the magnesia in this lime was combined with water, since the amount of carbon dioxide was found to be less than 1%. The quicklime from which this hydrate was prepared was very active and had been produced in the laboratory by burning the stone at a temperature near 1000 deg. C. for a short period of time.

Further results in the determination of the losses in weight when hydrated limes were heated at 325 deg. C. were obtained for various samples that had been treated with steam, hydrated with different amounts of water, or dried after the production of putty or wet hydrate from the quicklime. Representative results are given in Table IX and are found to support the ideas that have already been suggested concerning plasticity. They show that a great loss in weight due to the volatilization of water, combined or otherwise, is attended by low plasticity of the putty except in the case of those limes that are hydrated with an excess of water and made into putties without the formation of a completely dried intermediate product.

TABLE IX—DEHYDRATION OF HYDRATED LIMES RESULTING FROM DIFFERENT TREATMENTS WITH WATER AND STEAM

Lime No.*	Method of Hydration or Treatment After Hydration	Magnesia Hydrated Per cent	Plasticity No.
2	Hydrate in steam	54.78	60
2	Hydrated with 200% its weight of water, dried	78.54	130
3	Com'l hydrate treated with steam under pressure, dried	67.98	183
3	Com'l hydrate treated with steam under pressure, wet, not dried	66.00	255

*All limes were plastic.

Conclusions

The plastic properties of hydrated limes seem to be determined by the extent to which hydration progresses during the soaking of the lime to form the plaster putty. If the lime is completely hydrated at the time of the formation of the dry product, the hydroxides made at that time do not seem to be active in adsorbing water or in producing the colloidal state necessary for the production of a plastic putty. The presence of certain salts increases the plasticity. The most practical method of increasing the plasticity of a dry hydrated lime, however, seems to be so to control the temperature of burning and the rate of hydration of the quicklime that only the calcium oxide will hydrate when the dry hydrate is formed, while the magnesia will be sufficiently active to react with water upon standing in contact with it for a long period of time.

It has been found that a medium temperature, 1050 deg. to 1150 deg. C. under laboratory conditions, rather than an extremely low or an extremely high temperature, is best suited for the production of plastic finishing lime. The rate of the hydration of the quicklime, if it is ordinarily too rapid unless the lime is overburned, may be controlled by treating the stone before calcination with sodium chloride.

It has been found that the following treatments of lime result in a decrease in plasticity: Hydration with steam, treatment with steam after hydration, hydration with relatively greater amounts of water than are necessary for the reaction, and the drying of plastic putties. It is believed that the magnesia has been almost completely hydrated by each of these treatments. The whole of the lime is therefore inactive upon soaking, unless the hydroxides contained in it possess the property of adsorbing water, a property, which it would seem from commercial and laboratory experience, they are not likely to have.

The importance of the presence of hydrated magnesia in the dry hydrated lime and in the lime putties has been found by a study in the losses in weight of various limes when heated to 325 deg. C., and by the gains in weight of these limes when they are soaked in water for several hours.

Daily Summary Sheet as a Help in Bookkeeping in Rock Products Plants

A Detailed Explanation of Its Use by the Utah Sand and Gravel Products Corporation

By L. R. Snow

WE should first get a more definite meaning of the reproductions of our summary sheet appearing in ROCK PRODUCTS of October 16 and to help further explanations again shown with this article. The first reproduction is in no way a ledger sheet, but is a general summary sheet of ledger accounts. The reverse side of the "summary sheet," page 57, not only shows money received and paid out, but provides for all nominal accounts connected with the business, as sales, purchases, discounts, cash receipts and disbursements, etc. Or, to be more definite, reproduction, page 56, is a summary of the "general ledger" and cost controls; reproduction, page 57, a summary of transactions affecting nominal accounts.

Simple Accounting System Used

It would be well to give here a more detailed account of the accounting system of which this summary sheet is a part. The system in use here is what is known as the "Burroughs Adding Machine Simplified Accounting System." That is, it is a system of keeping books and accounts in which the Burroughs bookkeeping machine plays a major part in the recording of business transactions. There is very little pen-work connected with the system, all posting from original books of entry being done mechanically, both to the "general ledger" accounts and to the accounts "receivable" and "payable." Also, in the same operation, customers' statements are made which correspond in identical terms with the ledger account. This system of accounting is much faster and much more work can be done with less help than keeping books where all pen-work is necessary.

All accounts are known by number rather than by name, and in making entries and in posting, numbers only are used. For example: Account No. 101 represents "cash"; No. 304, "discounts taken," etc., or, all accounts have a number and that number is their identification card, so to speak.

Another feature of the system is that it is impossible to be out of balance at any time, providing the operator of the bookkeeping machine is accurate in his work. If by chance the operator picks up a wrong figure or total, the mistake can be traced and corrected very readily, ever so much quicker than if books were kept by hand.

By keeping the above explanation in mind we can now draw a little closer to the real worth of the "summary sheet." First of all, and probably the most important, is the fact that at any time one of these "summary sheets" is made up it shows an almost complete statement of the business, both as to "assets" and "liabilities" and as to "expense" and "revenue." Or, it provides a "balance sheet" and a statement of "expense" and "revenue." These statements are almost as complete as the statements rendered at the end of a fiscal period and can be made as complete with the addition of some accruals, deferred items, etc., which are not regularly accounted for in making up a sheet.

IN our Oct. 16, 1926, issue, in connection with the story on the Utah Sand and Gravel Products Corp., we reproduced both sides of a ledger sheet and a brief description of its use in keeping a daily general summary of materials and accounts at that plant. One of our readers has questioned the value of such practice at the ordinary rock products plant. To use his own words, he asks "What earthly good is a general ledger balance sheet to any corporation when it is a physical impossibility to get the invoices to purchaser in anything like time to get daily invoice?" The reply to this, by L. R. Snow, accountant for the Utah Sand and Gravel Products Corp., which we are publishing here, we are sure will more than answer that question, besides giving a more complete explanation of the application and value of the daily summary sheet.

The title "daily summary sheet" would imply that a sheet is pulled every day. This can very easily be done, but many times is not practical, and so the number of sheets made may vary with the volume of business transactions. When a sheet is completed and is in balance, the bookkeeper than knows his whole book system is in harmony. This he knows immediately if the net worth shows a debit balance and the revenue and expense statement shows a credit balance of the same amount; or, if the net worth shows a credit balance, the revenue and expense balance should show a debit balance to correspond.

Summary Sheet Furnishes Condensed Information

The "summary sheet," in the final analysis, is a sheet of condensed information of the business which it pertains to. The management at all times knows just what the business is doing. By reviewing the sheet one does not have to consult the cash book for a cash balance; the "accounts receivable" does not have to be proved to know its total; a company does not have to wait till the end of a fiscal period to know the profit or loss. With this system the management has the company's financial and operating conditions at close call and up-to-date. Having made the above short explanation of our system of accounting, we will attempt to answer the question: Of what value is a "summary sheet" to a company when it is impossible to receive invoices of purchases in ample time for a daily balance?

Application of System

It seems to us that this question is but a technicality and to treat it as a flaw in the system would be letting a very minor item overshadow the real worth of our whole accounting procedure. Let us analyze this questionable point. We are in the business of producing sand, gravel and crushed stone, all of which are natural resources. To these commodities we do not have to purchase merchandise to add to them to make them salable. Our problem is only to take these products from their natural deposits and prepare them mechanically for the market. Our plant, tramway and other fixed assets were all built before any operations began. Thus the only merchandise for us to buy consists of material to keep the original investment in repair and running order, and in this instance the greater part of such merchandise, consisting of screen plates, wire rope, etc., is shipped us by freight and in most cases we are in receipt of invoices and bill of lading before the goods arrive at our plant. We are therefore not so much a buyer of goods as we are a seller of commodities.

Let us suppose that conditions were such as the questioner pictures them, that invoices for material purchased arrives days

after delivery. It may be true that some materials would be received and in use when the invoice arrived, but we must consider that in only rare instances would that material be entirely consumed in a few days' time. On the contrary, the greater part of material purchased serves for many months. So we would ask, "Does the value of a 'daily summary sheet' fade into obscurity because we might have purchased some article and have that article in use for a few days before its cost is included in the sheet makeup?" We think not, for it is our belief that the value of this system is not resolved by such terms and technicalities,

DAILY SUMMARY SHEET
UTAH SAND & GRAVEL CO.
SALT LAKE CITY, UTAH

DATE
YEAR

MISCELLANEOUS JOURNAL ENTRIES

ITEMS	ACCT NO	DEBIT	ACCT. NO.	CREDIT

GENERAL LEDGER TRIAL BALANCE

NAME OF ACCOUNT	ACCT. NO.	BALANCE TO DATE
ASSETS: (CLEAR)		
CASH	101	
BANK	102	
STOCKS	103	
BOND COLLATERAL	104	
BOND DISCT RESERVE	105	
STOCK COMM RESERVE	106	
ACCTS. RECEIVABLE	107	
NOTES RECEIVABLE	108	
NOTES RECEIVABLE (EMP.)	109	
UNEXPIRED INSURANCE	110	
ELEC SERVICE ADVANCES	111	
DEPOSITS	112	
SUSPENSE	113	
FURNITURE & FIXTURES	114	
AUTO EQUIPMENT	115	
TOOLS	116	
PLANT DEVELOPMENT	117	
SUPPLIES	118	
OTHER ASSETS	119	
REAL ESTATE—S.L.	120	
REAL ESTATE—TAY	121	
MACHINERY & EQUIPT — S.L.	130	
MACHINERY & EQUIPT —TAY	131	
BLDGS., BINS & TRACKS— S.L.	140	
BLDGS. BINS & TRACKS—TAY	141	
PIPE LINES —S.L.	150	
PIPE LINES—TAY	151	
(SUB-TOTAL) TOTAL ASSETS		
LIABILITIES:		
CAPITAL STOCK	201	
BONDS	202	
BOND SINKING FUND	203	
SURPLUS	204	
PROFIT & LOSS	205	
RESERVE FOR DEPRECIATION	206	
RESERVE FOR DEPLETION & ROYALTY	207	
ADVANCES	208	
ACCRUED INTEREST	209	
ACCRUED TAXES	210	
NOTES PAYABLE COLLATERAL	211	
NOTES PAYABLE	212	
ACCOUNTS PAYABLE	213	
	214	
	215	
(CLEAR) APP NET WORTH		
REVENUES		
SALES S. L.	301	
SALES. TAY.	302	
TRUCKAGE SOLD	303	
DISCOUNTS TAKEN	304	
EQUIPMENT RENTAL	305	
MISCELLANEOUS	306	
(CLEAR) TOTAL REVENUES	350	
TONNAGE ACCOUNTS: (MEMO:)		
(ADD) TONNAGE MANUFACTURED	397	
(SUBT.) TONNAGE SOLD	398	
(CLEAR) TONNAGE STORED	399	
EXPENSE CONTROLS:		
MAINTENANCE & REPAIR—LABOR	400	
MAINTENANCE & REPAIR—MATERIAL	500	
OPERATING EXPENSE—LABOR	600	
OPERATING EXPENSE—GENERAL	650	
TRUCKAGE	690	
GENERAL OVERHEAD	700	
ADMINISTRATION	750	
OFFICE EXPENSE	800	
MISCELLANEOUS	900	
(SUB-TOTAL) TOTAL EXP		
(SUBTRACT) TOTAL REV		
PROFIT (CR)		
LOSS (DR)		

DETAIL OF EXPENSE AND COSTS

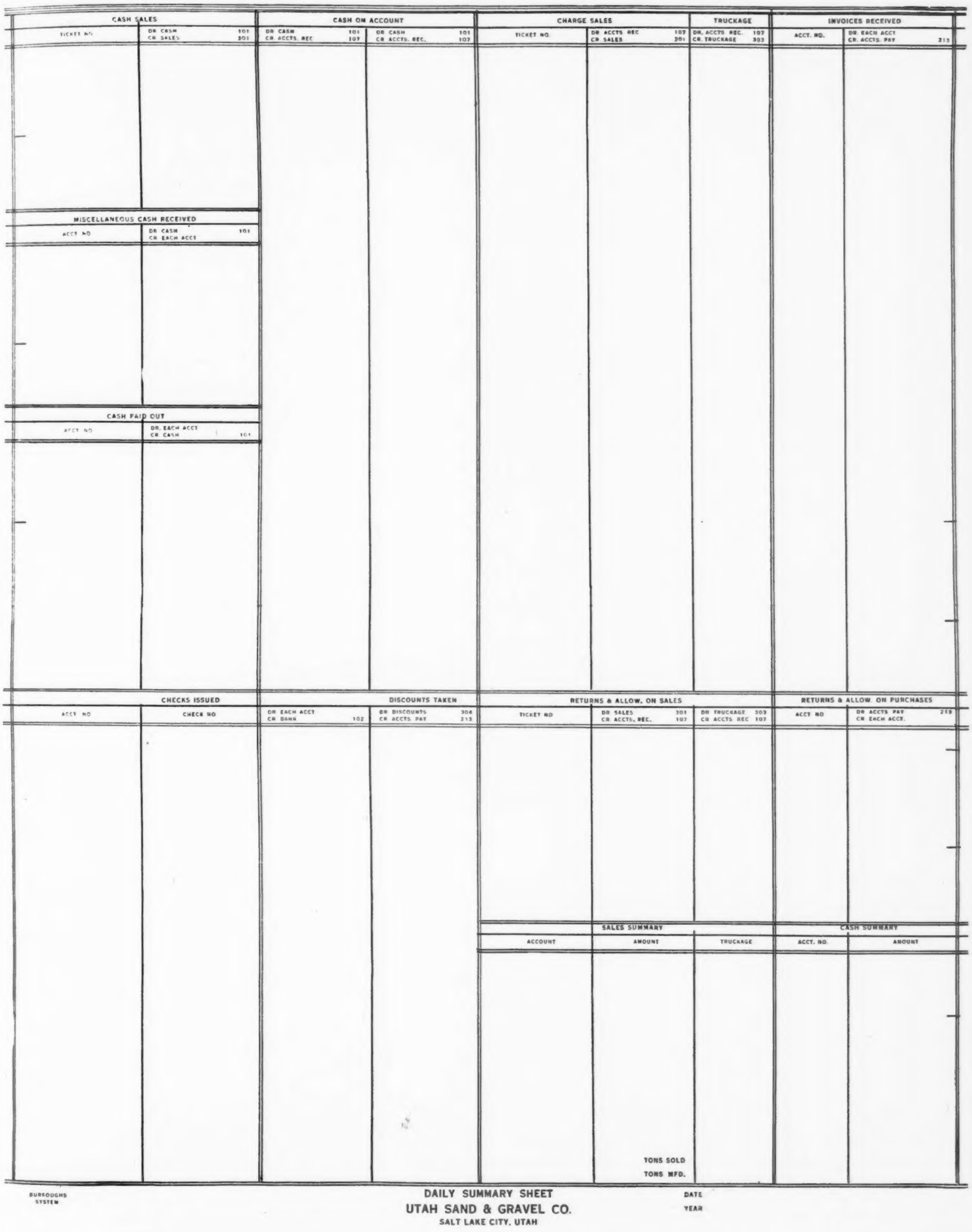
ACCOUNT	ACCT NO.	TOTAL TO DATE	ACCOUNT	ACCT. NO.	TOTAL TO DATE
MAINT & REPAIRS—LABOR	400		GENERAL OVERHEAD	700	
PIT & HOIST	401		ADVERTISING	701	
TUNNELS & TRAMWAY	402		TEL & TELG.	702	
BINS	403		INTEREST PAID	703	
CRUSHERS	404		DISCTS & ALLCE GIVEN	704	
CONVEYOR & FEEDER	405		SALES ADJUSTMENTS	705	
CHUTES	406		TAXES	706	
SCREENS	407		INSURANCE	707	
PUMPS & PIPE LINES	408		SURETY BONDS	708	
SETTLING POND	409		LEGAL EXPENSE	709	
SHOP	410		TRAVELING	710	
SUPERVISION	411				
			AUTOMOBILES	711	
MAINT & REP —MATERIALS	500		BOND DISCT EXPENSE	712	
PIT & HOIST	501		STOCK COMM EXPENSE	713	
TUNNELS & TRAMWAYS	502			714	
BINS	503			715	
CRUSHERS	504		MISCELLANEOUS	720	
CONVEYOR & FEEDER	505				
CHUTES	506		ADMINISTRATIVE SALARIES	750	
SCREENS	507				
PUMPS & PIPE LINES	508		OFFICE EXPENSE	800	
SETTLING POND	509		SALARIES	801	
SHOP	510		POSTAGE, PRINTING & STAT'Y	802	
	511		MISCELLANEOUS	803	
GENL & MISC	512				
OPERATING EXP —LABOR	600		MISCELLANEOUS EXPENSE	900	
PIT & HOIST	601				
TUNNELS & TRAMWAY	602		MISCELLANEOUS	901	
CRUSHING	604		SUSPENSE	902	
SCREENING	607				
SUPERVISION	611				
LOADING, BILLING & YARD	621		TOTAL		
STORAGE	622				
OPERATING EXP —GEN	650				
LEASE RENTAL	651				
WATER	652				
POWER	653				
SWITCHING CHARGES	654				
FREIGHT	655				
INDUSTRIAL INSURANCE	656				
OILS & LUBRICANTS	660				
TRANSF OIL	661				
CRUSHER OIL	662				
MOTOR OIL	663				
GEAR GREASE	664				
MISCELLANEOUS	665				
OPERATING SALARIES	670				

DATE
YEAR

Reproduction of ledger sheet in use at the Utah Sand and Gravel Products Co. Practically all the possible items of expense in the plant are indicated. By reference to the reverse side a summarized profit or loss statement can be drawn

which are rather close for the usual rock products plant.

We would suggest that anyone viewing our system of accounting judge it as one whole unit, so that its merits will justly be apparent, and we feel that if this is done it will need no sustaining argument. The system will be its own spokesman, to be accepted or refused after impartial investigation, and to us the Burroughs system of accounting is one of simplicity and value, as it accomplishes for us what is desired in bookkeeping—correct recording of business transactions that will be of the greatest value in the operation of our business.



CASH SALES
TICKET NO. | DR CASH 101 / CR SALES 301

CASH ON ACCOUNT
DR CASH 101 / CR. ACCTS. REC 107 | DR CASH 101 / CR ACCTS. REC. 107

CHARGE SALES
TICKET NO. | DR ACCTS REC 107 / CR SALES 301

TRUCKAGE
DR. ACCTS REC. 107 / CR. TRUCKAGE 303

INVOICES RECEIVED
ACCT. NO. | DR. EACH ACCT / CR. ACCTS. PAY 213

MISCELLANEOUS CASH RECEIVED
ACCT NO | DR CASH 101 / CR EACH ACCT

CASH PAID OUT
ACCT NO | DR. EACH ACCT / CR CASH 101

CHECKS ISSUED
ACCT NO | CHECK NO

DISCOUNTS TAKEN
DR EACH ACCT / CR BANK 102 | DR DISCOUNTS 304 / CR ACCTS PAY 213

RETURNS & ALLOW. ON SALES
TICKET NO | DR SALES 301 / CR. ACCTS. REC. 107 | DR TRUCKAGE 303 / CR ACCTS REC 107

RETURNS & ALLOW. ON PURCHASES
ACCT NO | DR ACCTS PAY 213 / CR EACH ACCT.

SALES SUMMARY
ACCOUNT | AMOUNT | TRUCKAGE

CASH SUMMARY
ACCT. NO. | AMOUNT

TONS SOLD
TONS MFD.

BURROUGHS SYSTEM

DAILY SUMMARY SHEET
UTAH SAND & GRAVEL CO.
SALT LAKE CITY, UTAH

DATE
YEAR

Reverse side of ledger sheet. This shows, in detail, money received and paid out daily and provides for all nominal accounts connected with the business

Vibrations Caused by Quarry Blasting and Their Effect on Structures*

Results of Quantitative Study Carried on by the General Crushed Stone Co.

By Professor Edward H. Rockwell
Dean of the College of Engineering, Rutgers University, New Brunswick, N. J.

MODERN methods of controlling the effects of well-drill quarry blasting have been perfected so as to render any vibrating effects transmitted through the air negligible. It is impossible to eliminate all effects of vibrating motion transmitted through the ground, although well balanced charges of explosives, such that the energy released by the blast is the minimum required to move the rock, will reduce earth vibration to the minimum. Some earth vibrations will of course always be present, and in cases of explosive charges of amounts from 2000 to 10,000 lb. of dynamite, the earth vibrations can be felt for distances up to 2000 or 3000 ft. People of a nervous temperament are prone to exaggerate these effects to an extent that makes popular description entirely untrustworthy.

The General Crushed Stone Co. became interested in a quantitative study of these earth vibrations and their effects on structures with the object of determining their magnitude and effects, if any, on the units of building construction such as floor joists, foundations, stucco walls and plaster walls and ceilings.

Upon starting this study, it was soon found that there existed practically no information whatever in regard to the actual amounts of movement and force exerted upon bodies caused by earth vibration. Some work was being done in Japan upon the effects of earthquakes on buildings, but even these results were not published in English at the time. It has of course been known for a long time that seismographs were in use at various universities to measure earthquake vibration, but actual methods of translating the results from these observations into suitable data for determining questions of structural safety were not available and earthquake seismographs are, of course, too large and unwieldly to be moved about, and are incapable of measuring the rapid vibration and small movement caused by the well hole blasting.

Recording Earth Vibrations

It was, however, discovered that two portable recorders had been built and it seemed advisable to secure one of these for experimental purposes in connection with this study, to secure records of the actual vibrations due to earth vibrations. The portable vibration recorders are in reality small seismographs employing the same fundamental scientific principles as earthquake seismographs, but of a much smaller size, and so constructed as to measure and record the much smaller but more rapid vibrations caused by blasting and by moving machinery. These vibration recorders had been used for recording similar vibrations and for determining by comparison the relative sizes of vibrations and their effects upon structures, but no actual method for translating these vibration records into quantitative forces or energy values had yet been used.

Mr. Deutsch, a consulting engineer of New York, owned one of these instruments; and he was retained to transport his vibration recorder to the quarry and secure records of blasting operations. Such records were obtained in various houses situated from 600 or 700 to 1800 ft. from the quarry upon at least five different occasions.

Various other methods such as setting up pencils and afterward groups of different sized steel pins were employed and were found to afford useful information corroborative in nature, which will be discussed later.

The vibration recorder afforded a considerable amount of information as to the actual amount and rapidity of the movements due to quarry blasting and recorded the information in permanent records.

*Paper delivered at 10th annual convention of National Crushed Stone Association, Detroit, Mich., January 20, 1927.

Part of the Winchester, Mass., quarry of the General Crushed Stone Co.

Harmonic Motion

The motion caused by blasting is the same in kind but not in amount to that caused by earthquakes and is called "harmonic motion." When recorded on a drum it looks like the sketch, Fig. 1, but is, of course, much smaller, although actually magnified by the instrument so that its dimensions can be scaled like any drawing.

Forces due to a blast cause actual movements of the ground and objects resting on it, back and forth in three co-ordinate directions, usually measured parallel to the

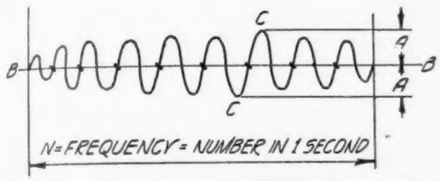


Fig. 1. Drum record of blasting motion

two sides of the structure and perpendicular to the ground; and the amounts of movement usually decrease as the distance increases, probably inversely as the square of the distance, but possibly at a greater rate, even as great as inversely as the cube of the distance.

The rate of vibration wave transmission is probably approximately equal to stress transmission in the material surrounding the quarry, which in rock is about 13,000 ft. per sec. or 2½ miles per sec (12 times the velocity of sound in air, 1089 ft. per sec.). The effect lasts only one or two seconds and the waves have a frequency from 10 to 15 per sec. in the cases examined.

A study of the fundamental facts in harmonic motion show that its important elements are the amount of actual movement in one direction from a position of rest called the "single amplitude" (total movement in both directions is called double amplitude $= 2A$), which is called A and shown on Fig. 1, and the "frequency" which is the number of complete waves transmitted in one second which is called "n."

Mathematical Relationships Involved

There are certain mathematical relationships involved in harmonic motion, such that a knowledge of the values of A and n enables one to compute what is called the maximum "acceleration," and also to compute the maximum velocity of motion.

From the quantities "amplitude," "acceleration" and "velocity" it is now possible to determine the forces acting on structures, the limits of deflection in short structures, and the energy that is present causing stress or tending to tip over objects. As in all structural computations it is also necessary to know the physical characteristics of the structures such as weight, size, dimensions, moments of inertia, material, moduli of elasticity and elastic limits of stress, but these are usually known or can be obtained.

It is useful as well as interesting to know that comparison of earthquake and quarry vibrations show for earthquakes (Japanese).

Amplitude $= 1.42$ in. $n = 1$ to $1\frac{1}{2}$ per sec.

Maximum quarry vibrations measured.

Amplitude $= 0.009$ in. $n = 10$ per sec.

The earthquake movement is, then, about 158 times as great, and one wave vibration lasts 7 to 10 times as long.

The calculated kinetic energy exerted on a residence of ordinary size would be about 400 times as great in the great Japanese earthquake as due to the maximum recorded quarry blast. These figures are not exact ratios of probable stresses in structures, but they afford a striking and useful comparison. "Acceleration" may be either positive or negative and is defined as the increase (positive) or decrease (negative) in the

Fig. 2. Energy of vibration is shown by the length of the pins which fall

velocity per second, during one second and is spoken of as

acceleration per sec. per sec. or

acceleration per sec.^{2}, and is

measured either in feet per second per second or inches per second per second.

The fundamental relationships of mechanics expressed in formulas are:

$$F = m\,a = \frac{W}{g}\,a$$

$$\text{K. E.} = \text{Kinetic Energy} = \frac{Wv^2}{2g} = \text{capacity for doing work.}$$

$$a = 4\,\pi^2\,n^2\,A$$

$$v = 2\,\pi\,n\,A = \sqrt{aA} \qquad v^2 = aA$$

in which

F = force due to acceleration in lb.

m = mass of body $= \frac{W}{g}$

W = weight of body in lb.

g = acceleration due to force of gravity = 32.2 ft. per sec. per sec. = 386.4 in. per sec. per sec.

a = acceleration in inches per sec. per sec.

v = velocity in in. per sec.

A = single amplitude in inches

n = frequency = number of vibrations per second.

The vibration record gives us the values of A and n.

From A and n the values of certain other quantities necessary for our purposes can be obtained and are:

F = force

a = acceleration

v = velocity

K. E. = Kinetic Energy = capacity for doing work.

In order to compute the actual stresses in bodies it is, of course, also necessary to understand the principles of structural mechanics including resilience, the formulas for which are too numerous to mention here.

Computing Forces Acting on Structures from Earthquake Vibrations

The usual method of computing the forces acting on structures from earthquake vibration is from the formula given above, i. e.,

$$F = \frac{W}{g}\,a = \text{force acting on body}$$

As shown in an article published in *Engineering News-Record* for December 27, 1923, the force F is considered to be equivalent to a static force for the purpose of computing stresses.

It should be remembered, however, that this is the force acting upon a moving body and is the force which is producing motion and during parts of the vibration is acting so as to increase the velocity of the body. If the period of vibration is relatively great, similar acceleration may produce much higher velocities and very much greater Kinetic Energy in one case than in the other inasmuch as K. E. varies as v^2. Since K. E. $= \frac{Wv^2}{2g}$, twice the velocity will produce four times the energy and three times the velocity will produce *nine* times the K. E., etc.

When the velocity of motion is very small and the period also very small as in quarry vibration (maximum observed $v = .57$ in. per sec.) computations for stress from K. E. equations check very closely results from the use of $F = \frac{W}{g}\,a$ with F used as a static force.

When the amplitude, velocity and period of time are relatively large as in earthquakes, the acceleration is not necessarily much increased (8½ ft. per sec. per sec. in Japanese earthquake) and is not a proper measure taken alone, for determining stresses or the probable damage. The true criterion for stress or damage is the amount of K. E. generated in the body.

This is shown by the following results on a house 26x42 ft. in plan, 30 ft. high and weighing 160,000 lb. The comparison is between the effects caused by a quarry blast 1800 ft. distant, as measured on a vibration recorder and the effect that would have occurred if subjected to the Japanese earthquake as recorded on a seismograph.

QUARRY BLAST

Acceleration	3 ft. per sec.^{2}
Velocity	57/100 in. per. sec.
F	15,000 lb., 12 lb. per sq. ft.
K. E.	67 in.-lb.

EARTHQUAKE

Acceleration	$8\frac{1}{2}$ ft. per sec.^{2}
Velocity	12 in. per sec.
F	42,500 lb., 34 lb. per sq. in.
K. E.	30,000 in.-lb.

The acceleration due to earthquake is only 2.8 times that due to quarry blast but the Kinetic Energy is 448 times as much.

In the above case the stresses caused by the quarry blast were about equivalent to those caused by the total static force $F =$ 15,000 lb. on the house, or by a wind of 12 lb. per sq. ft. on the side of the house, and were insignificant in all the units of the building with factors of safety in the frame of at least 50 or 60, and with factors of safety for stucco and plaster of 5 or 6.

These results were checked by computations using the Kinetic Energy equations.

Using the force F for the earthquake would have shown results inside the safe values for all of the building units, but the correct use of the Kinetic Energy equation would show the frame probably intact, but distorted, while all plaster and stucco would be broken and probably destroyed.

Acceleration taken alone is not a safe means of comparison. All the factors, amplitude of motion, velocity of motion, acceleration, period of wave and Kinetic Energy must be used in computing and checking the stresses in the structure.

It is important to know that the conclusions from the vibration recorder records, to the effect that stresses from quarry blasting in the frame, floors, stucco, plaster and other units of ordinary buildings are insignificant and far below those threatening any possible damage, have been independently confirmed by a series of rather simple but unique and extremely interesting experiments with steel pins.

During the early stages of our study and before quantitative results were obtained from the seismograph records, many simple expedients were tried such as using very full glasses of water, and by setting up ordinary pencils. In none of these cases did water spill from the glass, nor did a pencil tip over during any of the blasts, which made us rather skeptical about claims that persons had been thrown out of chairs or that dogs had been thrown clear across kitchen floors.

Development of the Pin Test

The pencil experiment led to the use of $\frac{1}{4}$-in. diameter steel pins from a few inches to 15 in. in height, which were very carefully made perfectly square on the ends (and somewhat concave) so as to insure absolutely even bearing. These were set up on hard level surfaces in frames such that in tipping over no pin would tip over its neighbor. These groups of pins were set up in various locations at various distances from the quarry face, on a large number of occasions, and in practically no case over 200 ft. from the quarry did any of the pins fall during a blast, and even at this close proximity only the 15 in. were affected.

After some study, methods of applying the principles of work involving Kinetic Energy were employed such that the amount of energy applied to the pin by the blast was equated to the amount of energy necessary to tip over the pin, and from these equations it was possible to prophesy about what the upper limits would be for acceleration, amplitude and velocity of motion, caused by the blast. For instance, if a 15-in. pin tipped over, but a 12-in. pin failed to do so, then the components of motion would at least be smaller than enough to tip the 12-in. pin, inasmuch as the higher the pin the easier it is to tip it over.

The seismograph records were checked by the pin experiments to the extent that at one house 1800 ft. from the blast, the recorded vibration indicated that the vibration would have been just a small amount less than enough to tip over a 15-in. pin. No 15-in. pin has been tipped over by similar blasts, even when closer to the quarry, therefore the seismograph record indicates vibrations at least as great as indicated by the pins.

The check could be made more apparent by showing the computations giving these results.

In general I believe that the pin experiment is highly significant and can be used with confidence when a more accurate record from the portable vibration recorder is not available.

In a series of at least five or six experiments with the vibration recorder using up to 10,000 lb. of dynamite and breaking off quantities of rock up to 40,000 tons the records show a frequency of vibration from 10 to 15 per sec. with a maximum amplitude of motion $= 0.012$ in. and a maximum acceleration of about 4 ft. per sec. per sec.

These results were obtained in a residence 1800 ft. from the blast, but smaller results were recorded in other houses much nearer and with larger charges of dynamite. These components of motion are theoretically very close to the amounts necessary to tip over a 15-in. pin. Stresses caused by motion of this magnitude are moreover very far inside the safe stresses in building materials. Therefore, I am quite firmly of the opinion that reliance can safely be placed on the pin experiment, certainly to the extent that any blasts failing to tip over 15x$\frac{1}{4}$ in. pins are well within the safe limits of ordinary building construction. It is interesting to note here that the great Japanese earthquake produced 100 times enough energy to tip over a 15x$\frac{1}{4}$ in. pin.

A number of examples of vibration with the necessary data are referred to in *Electrical World,* Vol. 66, No. 25, p. 1356. Computation shows in three of the cases cited that the Kinetic Energy developed by machinery vibration on bodies of similar size and weight would be greater than due to any case of blasting at Winchester, Mass. In one case the Kinetic Energy was 31 times as great, and in another six times as great, yet observation failed to note any structural damage whatever.

Another interesting case was that of a record of a man walking in a house, following one taken of a blast. In this case the values were

$A = 0.0036$ in. $v = 0.25$ in. per sec.
$n = 22$
$a = 5.7$ ft. per sec. per sec.

The amplitude of motion is less than most of the blasting records.

n is much higher than in any of the blasting records, but

a is larger than found in any case of blasting, but v is very small.

The Kinetic Energy on a 15x$\frac{1}{4}$ in. pin is about 40% of the amount caused by the worst case of blasting, which is the true basis of comparison. The fact that a is larger than in any case of blasting taken alone is not significant.

Method of Determining Whether or Not Pins Will Tip Over Due to Vibrations

The amount of work expressed in inch-pounds (in.-lb.) necessary to tip over a pin is closely, $\dfrac{wd^2}{4}$

The exact expression is somewhat difficult to employ, and as the approximate expression $\dfrac{wd^2}{4}$ is very close for pins having a value of $h =$ height, several times the magnitude of $d =$ diameter, it is quite satisfactory for practical use.

The amount of Kinetic Energy set up in the pin by any motion, including vibratory motion, is:

$$\frac{Wv^2}{2g} \text{ in which } W = wh \text{ and } v^2 = aA$$

$$\text{hence, } \frac{Wv^2}{2g} = \frac{wd^2}{4}$$

$$\frac{whv^2}{2g} = \frac{wd^2}{4} \text{ from which}$$

$$v^2 = \frac{gd^2}{2h}$$

$$v^2 = aA = \frac{193.2\,d^2}{h} \text{ and}$$

$$v = \frac{13.9d}{\sqrt{h}}$$

This is the velocity such that the Kinetic Energy just equals the amount of work required to upset the pin.

$W =$ total weight of pin in pounds.
$w =$ weight of pin per linear inch.
$h =$ height of pin in inches.
$d =$ diameter of pin in inches.
$v =$ maximum velocity of pin during vibration in inches per second.
$g =$ acceleration due to gravity.
$= 32.2$ ft. per sec. per sec. $= 386.4$ in. per sec. per sec.
$a =$ maximum acceleration of pin during vibration in inches per sec. per sec.
$A =$ maximum single amplitude of motion in inches.

Assume a 15x¼-in. pin, then the velocity of motion required to tip it over is,

$$v = \frac{13.9\text{x}\frac{1}{4}\text{ in.}}{\sqrt{15\text{ in.}}} = 0.9\text{ in. per sec.}$$

In the case of the residence referred to above which shows the worst situation in regard to effects of quarry blasting the maximum value from the seismograph were $A = 0.0127$ in., $a = 4.24$ ft. per sec.², $n = 10$, from which $v = 2\pi nA = 6.2832 \times 10 \times 0.0127 = 0.80$ in. per sec. or an amount just below that required to tip over a 15x ¼-in. pin.

The type of building considered in the investigation outlined above has been that of a comparatively low kind in which the ratio of height to width would be somewhere near unity, and no consideration therefore has been given to the question of a natural period of vibration of the building itself. If the structural stability of chimneys or very high buildings is to be considered it will probably be necessary to introduce the matter of the natural period of vibration of the structure inasmuch as the building movement will be increased when induced and natural periods of vibration are approximately the same, and the movements will be retarded when the induced and natural periods are quite different.

It has been shown that vibrating motion caused by well-hole blasting as conducted at Winchester, Mass., produces stresses in structures far below the safe values commonly used in design. It is, however, a common phenomenon to find cracks, distortion and damage to plaster in practically all building and particularly in residences of an ordinary or cheap type of construction, and entirely regardless of their location in proximity to quarries or not.

A study of vibrating motion shows that it consists of motion rapidly alternating in opposite directions. Therefore all the results of this motion such as force, acceleration, velocity and stress are also alternating in opposite directions and these respective quantities are of exactly the same intensity in each direction.

It is a well known principle in structural mechanics that shear cracks in beams always start near the largest transverse forces or reactions and traverse the beam by angles approximately 45 deg. with the neutral axis of the beam.

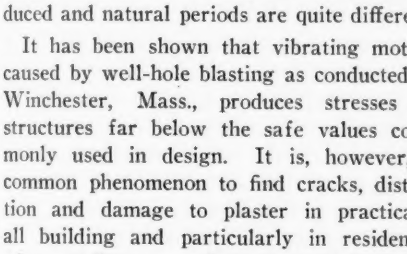


Fig. 3. Shear cracks in beams

These cracks are shown in Fig. 3 in full lines.

If the shear is acting down as shown in dotted lines by R_1, then the shear cracks are shown also in dotted lines. If sufficient to cause cracks, equal reversing forces as R and R_1 will cause cracks approximately at right angles to each other and approximately at 45 deg. to the neutral axis.

Those of you who have seen earthquake damage or even pictures of cracks caused by earthquakes will recognize immediately that cracks crossing approximately at right angles are a distinctive characteristic of vibratory motion if sufficient to cause any damage at all and that the phenomena of cracks in one diagonal direction only indicate forces or movement in one direction only which are usually caused by settlement.

Cracks from Shrinkage

One particularly interesting illustration of this occurred in a certain residence which I personally examined, even using a level to accurately determine the amounts of settlement in the floors and partitions. This residence was 26x42 ft. in plan and a beam supported on Lally columns was carried through the center of the building over the cellar on the long axis. On this beam joists were supported from the side walls over which two layers of flooring was fastened. On the flooring a 4x2-in. strip of timber was laid on which 4x2-in. studs were erected for the partition which was carried up through three stories.

In addition there were two furnaces in the cellar, one on each side of the center beam and very close to it.

Please note that there is about 23 in. in depth of timber laid sidewise on the grain, or transversely, supporting the partition, while the outer walls were supported on studding resting on a base plate with only about 2 in. of transverse timber.

The important fact to be noted here is that the coefficient of shrinkage in timber transversely to the grain varies from 3 to 10%, while longitudinally the coefficient of shrinkage is about 1/10 of 1%, or from 1/30 to 1/100 as much, depending on the kind of lumber used.

The same construction using lumber laid transversely was employed at the second and third floors.

Level measurements showed that the middle partition at its center point had dropped ¾-in. at the first floor, 1⅛-in. at second floor and 1⅝-in. at third floor and paint marks on the brick chimney running up through this partition checked closely these amounts. Using a coefficient of transverse shrinkage of 4% for southern pine the probable shrinkage and therefore settlement of the partition at its center was very closely checked.

A proof that this settlement was caused by shrinkage was afforded when measurements taken in June with a damp cellar and no fire in the furnaces showed that due to dampness the partition had risen again about ½-in. from its position in February when the furnaces had thoroughly dried out the basement framing. The result of this settlement was equivalent to applying upward shearing forces at the wall supports and there were characteristic shear cracks in one direction only in the plaster on the partition at each end near the wall supports. The movements and resulting forces on the partition were about 110 to 120 times as great due to timber shrinkage as could possibly have been due to earth vibration and were entirely sufficient in amount to satisfactorily account for the damage.

Another type of crack in the outside stucco walls was found in which the cracks were near the corners of the building perpendicular and parallel to the edges of the wall. Being perpendicular, these cracks were manifestly not shear cracks nor ones caused by vibratory motion. The stucco was not reinforced in any way and a consideration of the coefficient of expansion due to temperature change (0.00006 per deg. F.) fully accounts for such cracks.

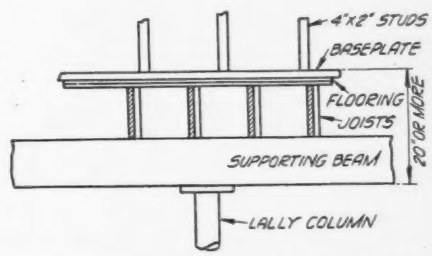


Fig. 4. The shrinkage developed in more than 20 in. of timber would cause cracking

Cracks in ceiling plaster may be caused by settlement of connecting partitions.

Usually ceiling cracks are parallel and perpendicular to the direction of the laths and are commonly due to contraction of the plaster itself or to the contraction or shrinkage of the lath itself. Fine hair-line cracks in ceilings sometimes occur and these are quite frequently due to fine particles of unslaked lime in the plaster.

Cracks in foundations and rubble masonry of all kinds are quite often due to the use of poor mortar.

Relative Safety of Cushioned Blasting

THE relative safety of cushioned blasting as compared with shots in which no air space exists between explosive and stemming is being studied by the Bureau of mines at its Pittsburgh experiment station. During the past fiscal year series of tests have been partly carried out to determine the charge limit of a permissible explosive in 8% natural gas-air mixtures under the different methods of loading in the borehole, and using different kinds of stemming. During the present fiscal year it is planned to complete the above series and include natural gas-air mixtures of less than 8% natural gas.

Some of the Changes Taking Place in a Rotary Cement Kiln

Study of Physical and Chemical Reactions Which Occur in the Different Zones

By E. S. and Wm. A. Ernst
South Dakota Cement Plant, Rapid City, S. D.

WHILE the rotary kiln is in universal use in this country for the purpose of burning portland cement clinker, it may not be amiss to give a short description of it for the benefit of those who may read this article and are not familiar with such a kiln. Briefly stated, it consists of a cylindrical steel shell from 6 to 12 ft. in diameter and from 60 to 300 ft. in length, lined with fire brick or other refractory material. It is supported at a slight inclination from the horizontal (a few tenths of an inch to the foot) on from two to three (depending on the length of the kiln) riding rings and friction rollers. The power to rotate the kiln is applied through a girth-gear and driving train, the speed of rotation varying from one-third of a turn to a complete turn per minute. Since the kiln is supported in an inclined position, its rotation has the effect of slowly working the raw material toward the combustion chamber and discharge end of the kiln.

In burning "slurry"—a wet, cement raw mixture—to finished clinker in the rotary kiln the material is gradually heated by its contact with the counter-current of hot gases which it meets in its passage from the feed end to the discharge end of the kiln. The hot gases, which may be produced by the combustion of oil, gas or powdered coal, produce changes, both physical and chemical, in the raw material. These changes take place in more or less definite, though overlapping, stages, which have the effect of dividing the kiln into several zones, the boundaries of which, though somewhat hazy, may be approximately defined. Operating conditions, such as the chemical composition of the mix, quality of the fuel, draft, speed of the kiln, etc., of course have the effect of varying the location of these zone boundaries somewhat.

Changes Occurring in Kiln

The first change which we would expect to find would be the complete evaporation of the water present in the slurry, followed by the burning of the organic matter and sulphur. This should take place for the most part in what might be termed the first zone.

The mix would then be heated to the decomposition temperature of the carbonates in the second zone. The iron, which is usually found in the mix in the ferrous form would be oxidized in the latter part of this zone, also. (This may be readily detected in some instances by the change in color from a buff or yellowish-grey to some tint of pink or red.)

In the third zone we would expect to find the material, which may still be considered as a mechanical mixture, freed for the most part from its carbon dioxide and heated to the clinkering temperature preparatory to being burned to the finished material in the fourth and last zone.

The following remarks deal with the results of a series of tests made by the authors to determine some of the chemical and physical changes which take place in a wet process cement kiln. They are submitted with the hope that they may be of benefit to someone, though no claim is laid to originality of thought, nor are they submitted with the idea that they present a new phase in this line of investigation, for such is not the case, Newberry, Campbell, Soper and others having worked along similar lines years ago. Due credit should be given to them.

The first of these pioneer investigators, however, dealt with the dry process and the short kiln common to the time. It was with the idea in mind of applying the same methods to the present day wet-process kiln and noting the changes which take place there during burning that the present tests were made.

To many this paper may not present anything new, though it has been the writers' observation that the number who seem quite unfamiliar with even the most simple of the reactions taking place in a rotary cement kiln is in the majority. It is to the latter group that this paper is principally addressed.

Test Conditions

The kiln under observation is 150 ft. in length, 10 ft. in diameter, and lined throughout with fire brick and insulated with "Sil-o-cel" brick for the first 100 ft. from the feed end. It was being fed a limestone-shale slurry mixture containing about 33% moisture and was fired with powdered coal of the sub-bituminous variety which carried a relatively high percentage of inherent moisture.

The analyses listed in table No. 1 and shown graphically in the chart were made on samples taken every 5 ft. throughout the length of the kiln. It was possible to do

TABLE NO. 1—ANALYSIS OF CEMENT CLINKER AT DIFFERENT POSITIONS IN THE ROTARY KILN

Kiln Position. No.	Analysis						
	SiO_2	R_2O_3	CaO	MgO	Loss	Insol. SiO_2	Sp. Gr.
1	13.57	7.04	42.87	1.45	35.07	12.36	2.45
2	13.58	7.52	41.99	1.54	35.37	12.33	2.56
3	13.61	6.98	43.10	1.37	34.94	12.62	2.54
4	13.62	8.08	42.41	1.49	34.40	11.50	2.60
5	13.91	6.80	42.11	1.78	35.40	12.39	2.61
6	13.67	7.06	42.55	1.37	35.35	11.87	2.64
7	13.61	7.06	43.36	1.35	34.62	12.39	2.60
8	13.70	7.82	42.24	1.38	34.86	12.03	2.61
9	13.71	7.26	41.83	1.55	35.65	11.75	2.61
10	14.05	7.02	42.87	1.47	34.59	12.35	2.60
11	13.60	7.60	42.32	1.37	35.11	12.31	2.64
12	13.62	7.51	42.41	1.29	35.17	11.30	2.63
13	13.83	7.51	42.29	1.47	34.90	12.05	2.65
14	14.01	7.39	42.70	1.38	34.52	11.84	2.67
15	14.04	7.07	42.97	1.93	33.99	11.75	2.64
16	14.16	6.48	43.67	1.91	33.78	11.87	2.64
17	13.90	7.67	42.88	1.39	34.16	11.48	2.68
18	14.04	7.69	43.41	1.43	33.43	11.32	2.69
19	14.29	7.69	44.37	1.37	32.28	11.13	2.67
20	14.70	8.18	46.24	1.36	29.52	7.80	2.69
21	15.18	8.88	47.33	1.60	27.01	7.32	2.67
22	20.77	11.82	52.12	1.47	13.82	3.35	2.98
23	16.85	8.26	50.82	1.86	22.21	5.93	2.82
24	24.04	13.77	59.59	1.78	0.82	0.36	3.15
25	17.16	9.86	53.18	1.88	17.92	3.74	2.89
26	17.33	9.25	53.30	1.75	18.37	3.12	2.79
27	18.24	9.78	56.16	1.99	13.83	2,64	2.89
29	20.10	11.21	61.51	1.54	5.64	1.74	2.81
29	21.20	11.29	64.18	1.82	1.51	0.80	2.93
30	21.32	Fe_2O_3 3.20, Al_2O_3 8.55	64.48	2.04	0.40	0.13	3.20

this during a temporary shutdown some months ago, since the kiln was allowed to cool under load. Some mixing of the material in adjoining zones was observed and expected due to the revolving of the kiln, which is necessary during the cooling process to prevent warping of the kiln. It will also be noticed that all of the analyses have been calculated to a dry basis of 100%. This was done to facilitate comparisons, since it was realized that the material at the feed end would naturally not be found in the same wet state as that to be expected under running conditions. The slurry was fed to the kiln containing approximately 33% moisture, but when sampled contained only about 1 or 2%, due to being exposed for several hours to the warm air passing over it.

Kiln Zones

The length of the drying zone can be readily recognized, however, by reference to the chart. During the first 40-50 ft. it will be seen that here is no appreciable permanent change in the percentage of lime or loss on ignition and that the specific gravity and insoluble silica remain approximately the same. The slight variations which do appear in this zone may be accounted for by segregation in the mixture after introduction to the kiln. A. Merciot ("Revue des Materiaux de Construction et de Travaux Publics," August, 1926) points out that "The pulverized material of cement . . . always has more or less of a tendency to flow, and this tendency causes the raw material to travel the length of the kiln at varying speeds with the result that different parts of the slurry have a tendency to separate from each other according to their various qualities."

For the next 35-40 ft. all of the percentages hold fairly constant. This we may term the second zone. It is here that the material is being heated to the decomposition temperature of the carbonates and where part of the CO_2 is driven off.

The third zone, if it may be considered as such, since such a variety of operations appear to take place there as to make the location of its boundaries most difficult, takes up the next 20-25 ft. In fact, it might be called the clearing-house for the second zone and the preparation chamber for the last zone since, as indicated in the graph, here still more of the CO_2 is driven off, the material is heated to the clinkering temperature and some combination and concentration takes place as shown by the lowering of the insoluble silica content and the increase in the specific gravity.

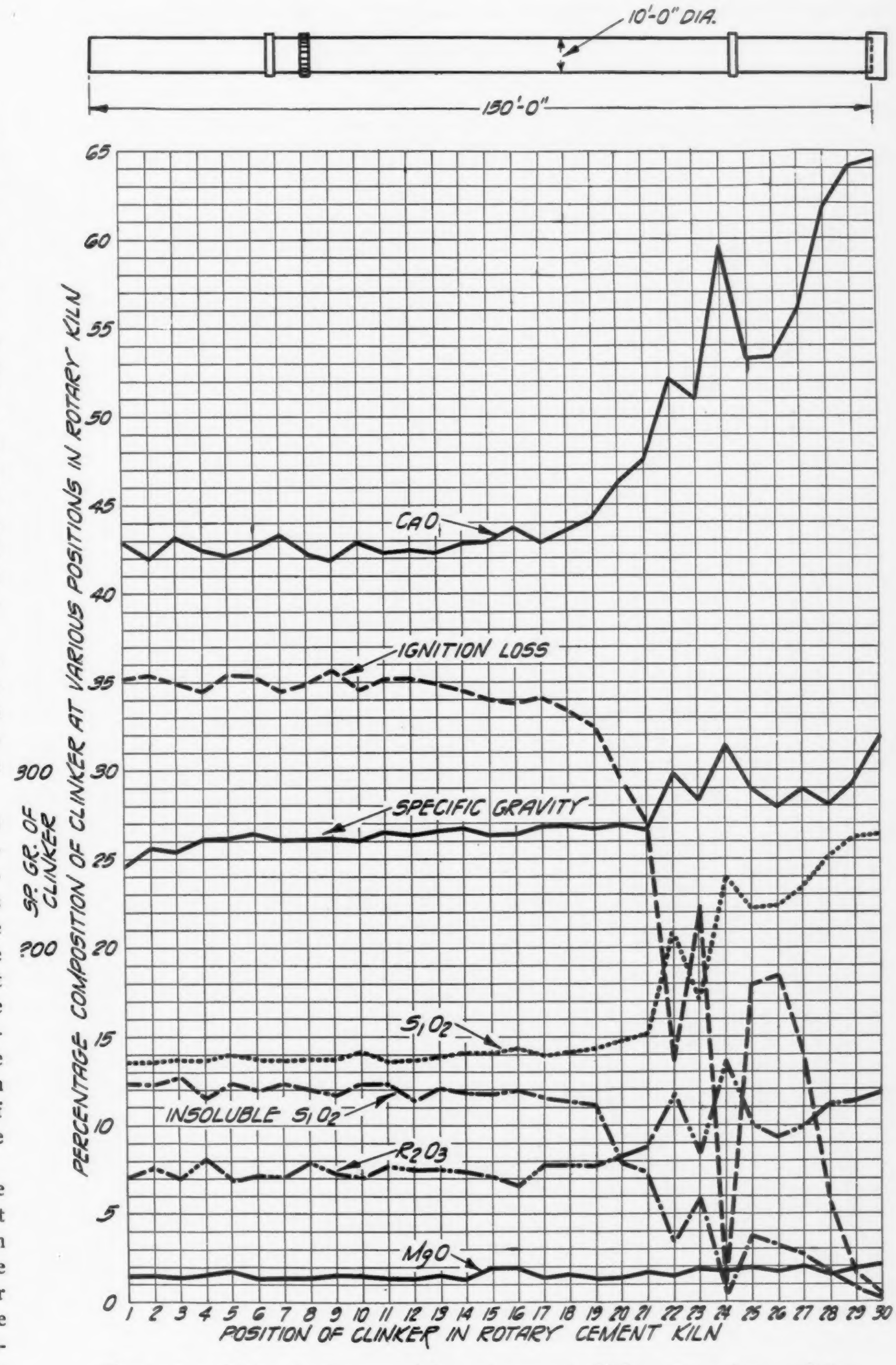
Clinkering is finally completed in the fourth and last zone. It is in this zone that several violent fluctuations in the composition of the mixture will be observed. These were caused by the presence of one minor and one major "fire-ring" in the kiln at the time of sampling. They are especially interesting in that they afford a comparison. It will be seen that they approach finished clinker in composition, though they are somewhat higher than clinker in the percentage of the oxides of iron and alumina which they contain. Omitting the analyses of the material taken at kiln positions 22 and 24 and then linking up positions 21, 23, 25, 26, etc., will produce the smooth curve which we would expect to find in the absence of the rings.

Physical Changes During Burning

The physical changes which take place in the mixture during the several stages of burning are in close agreement with those expected from a careful study of the graph.

From positions one to eight the material was found as greyish-yellow, irregular-shaped cake lumps and masses. At the latter station it started to change over to rounded nodules and powdered material which assumed a pinkish shade about position 11, the color increasing in intensity up to position 20, where it turned to a light buff shading into deep buff at positions 26-27, finally assuming the light steel-grey of powdered clinker. (The color of the material was judged by that of its powder.)

The nodules, resembling small marbles somewhat in appearance, which began to form at position 8, increased in number and hardness (they could be broken with the fingers) up to position 22, where they were



Physical and chemical composition of cement clinker at various points in a rotary cement kiln

found mixed with fragments of the fire-ring before mentioned. At position 23 white specks of uncombined lime appeared in the nodules. Position 24 again showed fragments of ring formation, though in greater amount than found at 22. Position 25 duplicated 23 except that the nodules were harder. At position 26 some of the nodules were found to have sintered exteriors and yellow centers, changing over to brown centers at position 27. Positions 28 and 29 showed under-burned clinker which broke down to dust on cooling and exposure to the air. Position 30 (the end of the kiln) gave hard, greenish-black nodules—finished clinker.

Chemically, the finished clinker will be found to closely agree with the formula advanced by Richard K. Meade,* which is based on the experimental work of Bates and Rankin at the Bureau of Standards and the U. S. Geophysical Laboratory.

The formula being:

$$\frac{2.3\,SiO_2 + 1.7\,Al_2O_3 + Fe_2O_3}{CaO + 1.4\,MgO - SO_3 \times 0.7} = 1.0$$

ACIDS

Silica	$21.32 \times 2.3 =$	49.036
Alumina	$8.55 \times 1.7 =$	14.535
Iron oxide	$3.20 \times 1.0 =$	3.200
Total		66.771

BASES

Lime	$64.48 \times 1.0 =$	64.48
Magnesia	$2.04 \times 1.4 =$	2.85
SO_3	$0.28 \times -.7 =$	-0.20
Total		67.13

$$\frac{\text{Acids} \ldots 66.77}{\text{Bases} \ldots 67.13} = 0.9946$$

This clinker when ground with the proper amount of gypsum (approximately 3%) produced a cement of high strength and normal set.

*Formulas for Proportioning Raw Materials in Cement Manufacture, Richard K. Meade, "This Journal," August 21, 1926, pp. 61-64.

Gordon Willis Explains Marketing of Lime to Chemical Industry

AN interesting survey on the manufacture and distribution of lime was recently published in a current issue of *Chemical and Metallurgical Engineering*. The author is Gordon Willis, president of the Hunkins-Willis Lime and Cement Co., St. Louis, Mo. Passing from a brief discussion of the raw materials entering into the manufacture of lime he proceeds to classify the lime produced from two different standpoints; methods of production and properties or uses. The following compose the first list:

Classification of Limes

Quicklime	Dead Burned Dolomite
Lump	Prepared Lime Plasters (dry)
Pebble	Prepared Lime Mortars (dry)
Crushed	Lime Putty
Ground	Ready-Mixed Wet Mortars
Pulverized	Ready-Mixed Wet Plasters
Hydrated Lime	Precipitated Carbonate
Masons'	Light
Finishing	Medium
Chemical	Heavy
Superfine	Limestone
Special Limes	Kiln Size
Arsenic free	Crushed
Vienna	Ground
Dairy	Pulverized
Milk of Magnesia	Air-Floated

Products of the industry classified as to uses are designated as follows:

Chemical.
Construction (limited to building operations).
Agriculture (limited to farm and orchard operations and the biological applications in this connection).

Basically, Mr. Willis says, all industrial limes are chemical limes; that is, in the process of operations in which they are used they perform some definite chemical function. In addition to this chemical function the results obtained with the lime may have been accompanied also by some physical action or physical property of the reagent. Further, the chemical function of the lime may very frequently be determined or modified by its physical properties. It is thus necessary in specifying lime to consider physical as well as chemical properties or requirements.

Specifications Show Wide Variation

The specifications for limes for different uses are wide and varied but strictly speaking they only define or describe a standard without defining limits. This is satisfactory, for they are used as basis for adjustment not usually included in contract agreements between producer and consumer. Adjustment sometimes is necessary because of the great number of uses of chemical lime and further because limes of different composition and characteristics may be used for the production of the same material, selection being determined by factors such as availability, type of process used, etc.

Of lime produced for sale, the building industry uses about 53%, chemical 41% and agricultural 6%. Seasonal variation in demand for chemical lime is relatively small as compared with the agricultural and construction lime. These last are concentrated over a period of about three months in the year. Further analysis of statistics discloses that the bulk of chemical lime was produced and distributed in six states, Alabama, Illinois, Indiana, Michigan, New York and Tennessee. This indicates a more or less greater concentration of outlets for chemical lime in or adjacent to these states.

Industry Generally Localized

Generally speaking, the producer uses limestone from deposits at or near his plant. In some few instances the stone is shipped considerable distances, but then only because of the need of certain qualities the stone possesses or low freight rates as, for example, Michigan high calcium stone being shipped to Buffalo, N. Y., and other lake points, northwestern Ohio dolomite stone going to distant points for burning, etc. The industry has tended to concentrate in certain areas owing to special characteristics of the raw material. This is best illustrated by the localization of the plastic lime industry in northern Ohio, the high calcium chemical lime producing centers near St. Louis, central Pennsylvania and in western Massachusetts and of the granular limes in a narrow region in New England.

Packing and Shipping of Lime

Shipments of chemical lime are generally made in bulk in box cars, whereas the quicklime is marketed usually in wood barrels or metal drums. The use of metal drum package is gradually increasing, particularly in the case of package of rotary-kiln quicklime. Hydrated lime is generally sold in 50 lb. paper bags and pulverized lime in 90 or 180 lb. paper bags of the valve type.

Lime is without competition in a number of its uses, but in those particular lines in which it does meet competition the efforts of competitors are vigorous and have been in the past extremely effective and successful. This situation exists probably more strikingly in the construction field than in the industrial field.

Materials competing with lime in all industries are as compared with lime relatively new developments and their production and use have been founded upon a just appreciation and an intelligent application of technology.

This competition has awakened lime manufacturers to the necessity for scientific and technical progress and has developed a desire to meet the requirements of the consumer and to sell him service as well.

Factors Influencing Competition From Other Materials

A number of factors have influenced this competitive situation not the least of which is the reduction in costs of production and resulting decreases in selling prices of some of the more important competitive materials. These conditions, of course, are the result of uncontrollable economic and scientific developments and are consequently unavoidable. Lime tonnages have been lost which can never be recovered and it is useless to make attempts at the recovery. There are, however, fields in which recovery can be effectd and a realization of the possibilities in these directions is one of the favorable effects of vigorous competition. These factors naturally develop competition not only from manufacturers of different materials but also among lime manufacturers themselves. Such a situation within limits must necessarily improve conditions within the industry itself and will stimulate technical developments as no other influence will.

Uses and Preparation of Rock Dust

A Discussion of the Manufacture, Equipment, Cost and Marketing Problems

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ROCK DUST, as the term is here used, means finely divided rock particles reduced by mechanical means from hard rock fragments. It may be made purposely or obtained as a by-product in the crushing of rock to secure the different commercial grades of crushed stone.

Sources of Rock Dust

Rock dust may be obtained from limestone, marble, slate, sandstone or the silicate rocks, but that obtained from limestone and marble constitutes by far the greatest amount, as it has wider distribution and more commercial uses than any of the others. Slate dust, pulverized slate or slate flour is used to some extent as a filler for asphalt pavements, in plastic cements, and in various molded articles of manufacture, and has been tried in linoleum and rubber. While used to some extent in these two latter materials, it has not proved as satisfactory as hoped for. Its production is limited to certain restricted areas, so is handicapped for general use as a substitute for other materials. Red slate flour is sometimes used as the pigment in paint for the burlap backing of linoleum.

Most dusts resulting from the grinding of sandstones are too impure to compete with pulverized silica sand, so abrasive uses are about the only outlet for this material.

The silicate rocks, such as granite and trap rock, would never be used primarily as a source of rock dust. In the preparation of commercial sizes, however, a certain amount of fines are unavoidably produced and constitute a by-product for which the quarryman desires to find a market. Due to its physical and chemical properties, it has little or no fertilizer value and cannot be used for mine dusting. Also, mainly due to its physical properties, there is little hope of its finding application in the field of high grade fillers, so silicate screenings are more or less restricted to structural uses as fine aggregate to replace sand. If ground sufficiently fine, they may find some outlet for abrasive purposes.

Limestone and marble dust may be divided into two general classes; first, comparatively coarse material, including agricultural limestone, dust for mine dusting, asphalt filler, and stock food ingredients; second, extremely finely ground products used mostly as a filler in various manufactured articles. The quantity produced of the first class greatly exceeds that of the second, but the price is much less, for restrictions as to fineness, color and chemical purity are not so hard to meet and the market is much greater. For most purposes marble dust may be used the same as limestone dust.

Presented at tenth annual convention of National Crushed Stone Association.

Use of Limestone Dust

Agricultural limestone is used to correct acidity in soils and as a soil conditioner. The benefits to be derived from its use are so well known that no discussion of its merits is needed here. Some states have advanced more than others in its use, but the general tendency is for a widening of its application, and it is safe to predict that there will be a rapid increase in consumption, not only in the districts where it is now employed, but in new territory, as the benefits to be derived are realized by the farmer. One disadvantage of the agricultural limestone business is its seasonal character, making necessary the accumulation of large stocks by the producer and wholesaler, or else the curtailment of production during the slack season, and very few producers are prepared to store large quantities in pulverized form. Possible seasonable demands might be partly overcome by proper educational campaigns and the offering of special inducements to the consumer during the slack season.

There has been much discussion as to the proper fineness for agricultural stone. Coarser stone takes longer to become available, but is cheaper. More finely ground stone is more rapid in its effect, but may have a tendency to pack in bins and bags and is sometimes more difficult to properly mix with the soil. Chemical purity is important only to the extent of having to pay freight and handling charges on inert material. Magnesium limestone is now considered equally as good as high calcium stone, and other things being equal, they should be given practically an equal rating. There are certain special conditions, however, where one or the other might be superior. There would be no advantage to either the producer or farmer in the establishment of rigid specifications, as what the farmer desires is a satisfactory product at the least price. This means a different product under different conditions of supply, cost of transportation, and length of haul from the railroad.

The following table, figures for which were furnished by the Statistical Division of the U. S. Bureau of Mines, gives the production and value by states for the year 1925. There was an increase of 45% in tonnage and 41% in value over 1924. The average selling price at the plant was $1.42 per net ton.

LIMESTONE FOR AGRICULTURAL PURPOSES SOLD OR USED BY THE PRODUCERS IN THE UNITED STATES IN 1925, BY STATES

State	Short tons	Value
Alabama	(*)	(*)
Arkansas	(*)	(*)
California	11,530	$37,584
Connecticut	(*)	(*)
Georgia	24,150	35,050
Idaho	(*)	(*)
Illinois	638,490	589,797
Indiana	127,220	125,685
Iowa	93,010	71,722
Kansas	2,120	3,991
Kentucky	39,420	48,972
Maine	(*)	(*)
Maryland	(*)	(*)
Massachusetts	36,980	210,314
Michigan	223,480	183,806
Minnesota	20,220	18,073
Mississippi	(*)	(*)
Missouri	40,090	54,668
Montana	(*)	(*)
Nebraska	(*)	(*)
New Jersey	(*)	(*)
New York	71,650	218,177
North Carolina	(*)	(*)
Ohio	230,270	280,747
Oregon	(*)	(*)
Pennsylvania	102,710	399,053
Porto Rico	(*)	(*)
Tennessee	79,230	135,529
Texas	(*)	(*)
Vermont	(*)	(*)
Virginia	44,860	76,686
Washington	(*)	(*)
West Virginia	12,100	30,445
Wisconsin	55,900	85,038
Undistributed	101,050	275,252
Total	1,954,480	2,880,589

(*) Included under "Undistributed."

Rock Dust for Coal Mines

Rock dust, properly applied, is now known to be a positive prevention of the propagation of dust explosions in coal mines. All bituminous coal dust is explosive and when stirred up into the mine atmosphere by a small gas explosion or defective blast, creates a condition favorable to a destructive explosion and mine disaster. England has mine regulations requiring the rock dusting of gassy and dusty mines. Other European countries recommend its use. In the United States no regulations are in effect, but rock dusting is strongly recommended by the Bureau of Mines, and many demonstrations of the explosibility of coal dust and the effect of rock dust in rendering it non-explosive have been made at the bureau's experimental mine near Pittsburgh. Rock dust is being used in many mines in Pennsylvania and West Virginia and in

some of the mines of Illinois, Indiana, Kentucky, Alabama, Wyoming, Utah and New Mexico, but probably not more than 20% of the coal mines of the country are at present being rock dusted. Instances are on record where dusting has undoubtedly prevented serious disasters. While standard specifications for rock dust for mine use have not been adopted, tentative specifications have been proposed in U. S. Bureau of Mines Serial No. 2606. Some abstracts from this are as follows:

"Standard rock dust for use in the rock dusting of coal mines might be defined tentatively as powered mineral, light colored and free of carbonaceous matter and free silica, all of which will pass a 20-mesh screen, while 50% of it will pass through a 200-mesh screen.

"Such dust may be prepared from limestone, gypsum, anhydrite, or shale free of sand and flint. For the initial rock dusting of the average nongaseous bituminous mines enough standard rock dust should be applied so that the combustible content of the resulting mixture of rock dust with mine dust shall not exceed 45%, a range somewhere between 35% and 45% being the practical objective sought."

Mine conditions as to character of coal dust and amount of gas in the mine air may allow, or make necessary, modification of these requirements. As coal dust is always being formed, redusting must be practiced, so there is a steady consumption of rock after the original dusting. A light colored dust is always preferable, as it gives an indication of the amount present and aids illumination.

No figures are available as to the total consumption in the United States, but its use is increasing rapidly. The amount consumed in any one mine is manifestly controlled by the amount of coal dust made and length of mine openings. The initial dusting may require from 10 to 15 tons of rock dust per mile of roadway or mine opening. Redusting during the year will generally require an amount much greater than this.

Asphalt Filler

Asphalt pavement mixtures require the addition of some inert mineral filler to make the mixture less susceptible to temperature changes, to toughen the mixture and aid in reducing the cost by acting as a harmless dilutant. The weight of filler used is approximately equal to that of the asphalt cement and the total filler used is in the neighborhood of one and one-half million tons per year. Other fillers, such as slate flour, are used, but limestone is the most common, partly because its physical properties seem to be best suited for this purpose and partly because of its wide distribution and relatively low price. Chemical purity is not important and specifications covering physical properties are not severe. Color is immaterial and dust from both fine or coarsely crystalline limestone is used. While all types of limestone dust are used, no doubt some would be better than others, but so far no comprehensive research to determine this has been carried out, and price is usually the controlling factor in making the selection. Specifications usually require that 100% shall pass a No. 30 standard sieve and at least 65% shall pass a No. 200 sieve.

Stone dust is used as a filler in molded asphalt blocks and asphalt joint filler for different forms of block pavements, but the total consumption for these uses is not large.

High Grade Stone Dust

High grade stone dusts include those used where color, texture, fineness of grain and chemical composition are collectively or individually important. Limestone and marble are the principal raw materials from which such stone dusts are prepared. There are several reasons for this. The color is usually white, or nearly so, and the finished product can thus be dyed or colored to suit. Excessive amounts of grit are usually absent, and this is often a requirement. Most limestones and marbles are easily ground, permitting a cost of production that makes marketing possible. Limestone dust, or whiting, as it is usually called, cannot be used as a filler when the finished article is subjected to the action of acids. In such cases some of the forms of silica are commonly employed.

Pulverized limestone is used as a filler in rubber, putty, paint, linoleum, kalsomine, soap, plasterboard, and many other articles of lesser importance. Rubber, putty, paint, linoleum and kalsomine account for probably 90% of the consumption. Some of the lesser uses are tooth paste, shoe polish, metal polishes, and similar products. For rubber the dust must be white or nearly so. Grit must be absent. Small amounts of magnesium carbonate are not objectionable. There is no standard of fineness, but most manufacturers wish a product 98% of which will pass a No. 300 sieve. Free alkalies must be very low, but most natural stone meets this requirement.

For putty, extremely fine grinding is not essential. A product all of which will pass a No. 150 mesh, with over 90% passing a No. 200 mesh, is satisfactory. Chemical purity is not important if the free alkalies are low. Texture, a character of the grain surface, is most important. Ground marble makes a putty which is "short" and unsatisfactory. Chalk makes the best putty, and very fine grained limestones, like some of the oolitic varieties, make a fair grade.

For paint, color is of first importance. The stone dust must be white, and the finer it is ground, the better. Chemical purity is unessential as long as free alkalies are low, as alkalies react with the vehicle. In rubber they affect the action of the organic accelerators. Oil absorption should be low, as linseed oil costs more than whiting.

Whiting for linoleum should be white, for although linoleum is usually colored, the manufacturer wishes to control the color entirely by the use of dyes or colored pigments, and an off-color whiting would affect the desired shade sought. Extreme fineness is not essential, in fact, is undesirable. Grit must be absent, but the texture or character of the surface of the grains does not seem of extreme importance, as whiting from highly crystalline limestone is satisfactorily used.

Most kalsomines consist of about 80% whiting, 20% white clay, and pulverized glue for a binder. The whiting must be white and is usually ground so that 98% will pass a 200-mesh sieve. Chalk is better than limestone whiting, as it does not settle out so rapidly, is more opaque, and brushes better. Some grades prepared from limestone are, however, used. Chemical purity is not essential. Most of the grades used for this purpose are ground wet.

Some limestone dust is used as an abrasive in certain soaps or hand cleaners. It is a comparatively coarse product, about all passing a 60-mesh sieve. Chemical purity is not important, but the color should be light. For plaster board a white product is essential and the stone is ground to medium fineness.

The quantity of whiting used in tooth paste is negligible as compared with other commercial uses. Very little natural stone dust is used, as the best grades of paste use only a calcium carbonate precipitated from a lime solution. Metal polishes require a whiting free from grit, and preferably light colored. The fineness depends upon the grade of polish made.

Use in Ceramics and Glass Making

Ceramic whiting is the different forms of calcium carbonate used in glazes, enamels and, rarely, in ceramic bodies. Chalk is occasionally used, but by far the greatest amount consists of pulverized marble and limestone. It should be uniform in quality, both as to fineness of grain and composition. It should be practically free from particles of pyrite, iron-bearing silicates, metallic iron and gypsum. It is usually divided into two classes or grades, one a high calcium and the other permitting a considerable amount of magnesium. The first class should contain not less than 96% calcium carbonate, with not more than 2% magnesium carbonate. The second class should contain not less than 89% calcium carbonate and not more than 8% magnesium carbonate. In both classes, iron oxide should not exceed 0.25%, the silica 2%, and the total sulphur computed to SO_3, 0.1%. Ninety-nine per cent should pass a No. 140 sieve and 98% a No. 200 sieve. At least 48% should be finer than 0.01 mm.

Calcium oxide is a necessary constituent of glass. It may be used in the form of

quicklime, hydrated lime or pulverized limestone, depending upon conditions of manufacture and price. Some manufacturers require a high calcium stone, while others require one high in magnesium. One manufacturer stated that in making sheet and window glass by the drawing process, the use of a high magnesium lime prevented devitrification, which caused trouble if a high calcium lime were used. A material in which the ratio of lime to magnesia was 7 to 3 was considered desirable. Iron is undesirable and should not exceed 0.2% for good glass. The combined calcium and magnesium carbonates should not be less than 97%. The crushed and sized stone must be free from chert, flint, clay or overburden debris. A fairly coarse product compared with other grades of stone dust is desirable, for a product passing 6 mesh and retained on 30 mesh is ideal. Often the fines are not entirely screened out.

Prices of Various Stone Dusts

Wholesale prices of stone dust, or pulverized limestone, vary between quite wide limits, depending on the location, competition and quality of the product. In November, 1926, agricultural limestone was quoted all the way from $1 per ton for a product of which 50% would pass 100 mesh to $6 per ton for material 90% of which would pass 100 mesh. Intermediate quotations seemed to be based more on the price that could be obtained rather than on any specified quality, as quotations of $1.35 per ton for material running 90% through 100 mesh were noted, as well as $3.50 per ton for material all passing 14 mesh. The bulk of the production, however, is sold for between $1 and $2 per ton.

Stone dust for mine dusting is quoted at from $3 to $5 per ton, depending on location and whether shipped in bags or bulk.

The price of high grade fillers varies quite as much as that for agricultural limestone. Probably some grades 98% of which will pass a No. 200 sieve sell for as low as $5.50 per ton. Material suitable for rubber, paint, putty and the like brings from $7 to $15 per ton at the plant, depending on purity, fineness and location. Whiting or high grade stone dust is nearly always shipped in bags.

Preparation of Stone Dust

Methods of preparation of stone dust are of as much interest to the producer as the various commercial uses of the product. Equipment is selected which will produce the desired grade at the least cost, all things considered. This requires considerable investigation, as some manufacturers are prone to recommend their machines for any kind of service. In installing new equipment the operator will usually be guided by the experience of others producing a similar product from the same kind of raw material. Equipment which would be suitable for pulverizing agricultural limestone obviously would not do to make a high grade whiting, and a machine suitable for the latter would not be efficient on agricultural limestone.

The coarser grades of stone dust were originally obtained as the fines passing the dust jacket on the coarse crushing plant screens. Very considerable amounts are still so made, but the rapid increase in consumption has in many cases made the installation of an auxiliary plant advisable. This takes the dust from the screen and also such other fine sizes as cannot be readily marketed, or on which a better profit can be made in the form of pulverized stone.

At the majority of plants some stone dust is a side issue, and the feed going to the pulverizer has already been reduced to the proper size in the primary crushing plant. If it has not, necessary crushing machinery is required, but this is of the usual type.

Crushers and Pulverizers

For agricultural limestone, three types of crushers are employed, the hammer mill, the ring roll, either horizontal or vertical, and the ball mill. The hammer mill crushes largely by impact and sheering, the ring roll mostly by pressure and abrasion, and the ball mill by impact and abrasion. The hammer mill has large capacity and low first cost calculated on a tonnage basis. However, it is not suited for very fine grinding, and, if the market demanded such a product, it would have to be operated in circuit with a screen, the oversize being returned to the mill. This, with the necessary elevating equipment, would increase first cost and operating cost. Also, the proportion of extremely fine material would be less than in that of the products from the other two types. Where the market will take its product it is probably the best pulverizer to use.

There are several forms of ring roll pulverizers on the market. In some, the mullers or rollers are pressed against the grinding ring by spring pressure, and in others by centrifugal force. They are susceptible of considerable adjustment for size of finished product. Their capacity is good unless an attempt is made to grind too fine in one operation without a screening or separation of the product and return of oversize to the mill. Some forms operate with a current of air through the mill to remove the fines as rapidly as reduced, and these are more especially suited to fine grinding for other purposes than agricultural stone. In others, the product is immediately discharged from the mill and the separation of oversize made on screens or classifiers. These consume less power per ton of material ground, but require more mill space and introduce additional dust problems. The capacity of ring roll mills, like all others, is greatly affected by the degree of fineness of grinding. Very fine grinding with any type of pulverizer is attained only at the expense of tonnage.

Ball mills have been but little used in the production of agricultural limestone, but they have some very desirable features which should recommend them for this duty. They are very simple in a mechanical way, have fair capacity, and maintenance charges are low. For agricultural stone, a short mill of large diameter using steel liners and balls is the most efficient type. For the finer grades of agricultural limestone, asphalt filler, and for rock dusting, the discharge is sometimes accomplished by drawing a rapid current of air through the mill to sweep out the material which has been reduced to the proper fineness. The suspended dust particles are separated in a cyclone collector and the air returned to the mill in a closed circuit. Otherwise the discharge through the trunnion of the mill is passed over screens or through air separators to remove the oversize. For the coarser grades of agricultural limestone, screening may not be necessary unless the mill is crowded to capacity. Very hard rock, such as sandstone, quartzite, trap rock and granite, can be successfully pulverized in a ball mill which could not be handled in the other types on account of the hardness and toughness of the rock.

In the preparation of whiting and high grade filler material, quality must come first; capacity is second. Ring-roll mills or tube mills are usually employed. Ring-roll mills always grind dry, while tube mills may be operated wet or dry, although wet grinding is only employed in the preparation of the finest grades.

Manufacture of Whiting

A ring-roll mill in which the fines are removed by a current of air sweeping through the mill is the form usually used, although there is no reason why mills with gravity discharge may not be employed. The former types, however, are self-contained and, by operating in a closed air circuit, partly solve the dust problem, which is a troublesome one around dry-grinding plants. The air system is also usually equipped with an air separator or classifier as an integral part, the oversize being returned automatically to the pulverizer. If the mill has a gravity discharge, the air separator is operated as an independent unit. Ring-roll mills in connection with an air separator can produce material 98% of which will pass a 300-mesh sieve, but of course the capacity is very much less than when grinding to, say, 150-mesh. They can handle all grades of limestone and dolomite, but are especially suited to the softer grades of stone. Possibly ceramic whiting could not be made from a hard stone on account of contamination with particles of metallic iron. Probably more whiting is prepared in ring-roll mills than in any other kind.

Tube mills are used to a considerable extent in grinding the better grades of whiting, and must always be used if a wet-ground product is desired. Their use is probably

increasing. They may be of the usual cylindrical form or of the conical type with an elongated cylindrical central part. If contamination with fine particles of metallic iron is not objectionable, steel or alloy steel lining is used with steel balls as grinding media. For the best grades of ceramic whiting the mill is lined with flint blocks and flint pebbles replace the steel balls. Greater capacity is obtainable with steel balls than with pebbles. Tube mills may be operated with the ordinary trunnion discharge or be operated on the air-swept principle. In either event, classification or removal of oversize is done outside the mill. It is almost certain that the ordinary discharge will yield a product with a greater percentage of very fine particles than will the air-swept mill; that is, particles much finer than the opening in any sieve that can be made, say, 0.005 mm.

The fineness of the finished product can be controlled by regulating the feed and varying the pebble load, but some time must elapse before the change takes effect. In this respect the ring-roll mill, with self-contained classifier, is superior, as adjustments of the classifier can be quickly made and are immediately effective.

Sizing or Classification

If specifications demand a product all of which must pass a certain mesh, some form of separator or sizing device must be employed to secure the greatest efficiency from the pulverizer, as the capacity is greatly reduced if an attempt is made to grind to a fixed maximum size in one operation. In dry grinding, screens or air separators are the only means available.

Screens may be of cylindrical rotating or flat vibrating or shaking type. Twenty mesh is about the limit of fineness for revolving screens, and even with this size the efficiency is low. Vibrating or shaking screens as fine as 150 mesh have been employed, but the capacity is small and the cost of screen cloth replacement is high. The mistake is often made of providing insufficient screening surface. Generally speaking, 60 mesh is about as fine as can be used efficiently, and for finer material better results are obtainable with some form of air classifier or separator, although the result may not be as positive. The principle of all forms of air classifiers is much the same. The finely ground material is dispersed in a current of air which has a proper velocity to carry off the particles sufficiently fine and drop out those that are too coarse. The result is accomplished by various mechanical means. In some, the dust is thrown into a rising current of air by centrifugal force acting in a horizontal direction. In others, the coarse particles settle out of a horizontal air current, and in others the fines are carried upward with the rising current, while the coarse grains drop back into the oversize compartment of the separator. The material must be sufficiently dry so that good dispersion of the particles in the air is possible with a minimum of grains adhering to each other.

If wet grinding is practiced, water classification is employed. A number of types are available. This is followed by thickening and filtering to remove excess water, or by sedimentation, which is slower but requires less mechanical equipment. Drying of the wet pulp is accomplished in different forms of dryers, but those in which steam is the heating medium are more satisfactory, as great care must be exercised not to overheat the product. Film dryers in which the whiting in suspension in the water is sprayed on the surface of a revolving drum internally heated by steam have proved quite satisfactory.

Cost of Grinding

Grinding costs manifestly depend upon many factors, such as toughness of rock, capacity of plant, power cost, fineness of grinding, and type of pulverizer used, and generalized figures only, even for the same grades of rock dust, can be given. In the estimates following, only the costs beginning with the stone small enough to feed to the pulverizer are considered, and quarrying and preliminary crushing are not taken into account.

A manufacturer of a pulverizer of the ring-roll or ring-ball type estimates the cost per ton with capacity of four tons per hour to 90% through 100 mesh as 56c per ton. This takes into account depreciation, interest, repairs, power at 1c per kw.-hr., and labor 50c per hour.

A manufacturer of hammer type pulverizers for agricultural limestone estimates the cost at 20c to 60c per ton, depending on the hardness of the stone and size of plant.

A manufacturer of an air-swept ball mill states that the average cost of pulverizing is about $1 per ton, less than this for a 100-mesh product, and considerably more for 200- or 300-mesh material. This is obviously guesswork.

A manufacturer of a ring-roll mill gives the cost at a capacity of five tons per hour to 75% through 200 mesh (a rather fine agricultural stone) as 57c per ton. This includes depreciation, maintenance, interest, power at 3c per kw.-hr. and labor at 60c per hour. The same manufacturer estimates the cost at three tons per hour to 95% through 200 mesh as 87c per ton and 1.5 tons per hour to 99% through 300 mesh as $1.62 per ton.

A manufacturer of a special ball or tube mill, grinding 11 tons per hour to 50% through 200 mesh, gives the cost at 31c; with a capacity of 7 tons to 80% through 200 mesh for asphalt filler, as 47c; with a capacity of four to five tons to 96% through 200 mesh, as 67c; and three tons to 99.5% through 300 mesh, as $1.12 per ton. These estimates include power, labor, repairs, interest and depreciation. This mill is operated in a closed circuit with an air classifier.

A manufacturer of grinding equipment estimates the cost at a plant grinding 20 tons per hour wet in combined ball and tube mills as $1.07 per ton. This includes overhead, labor, repairs, power at 2c per kw.-hr., and maintenance. The estimate of overhead, which covers depreciation, interest, taxes and insurance, is 65c per ton, which seems out of line. The same manufacturer estimates the cost of grinding dry under the same conditions at 20% greater than this.

Estimates of costs made by manufacturers must of necessity be quite generalized unless applying to some particular installation, and they are usually based on ideal conditions and do not include management and supervision charges, which may be considerable for a plant of small capacity. Also, it is impossible to take the character of the stone into account. Actual figures often vary to an absurd degree, due to peculiarities of the plant and grindability of the stone, which latter may vary by as much as 100%. Also, a few per cent more or less retained on a certain screen may have a great influence on capacity and the cost.

Summary

The stone producer who considers entering the stone dust field for any reason has a problem to consider from a great many angles. He may have a waste product on hand on which quarrying and crushing costs have already been written off. The question then is, can he put this into such shape that it can be marketed at a profit? Available markets are of first importance. This includes not only the quality of material for which a market exists, but market location with respect to competition from other sources and distances from the producing plant. If markets can be reached, a study of his raw material must be made to see if it meets the particular requirements. Then must follow an estimate of the cost of the plant and cost of operation, which, of course, is controlled by the capacity, and quality of material which it is proposed to produce.

Standard Lime and Stone to Erect Cement Plant

THE Standard Lime and Stone Co., Baltimore, Md., with plants in Maryland, Virginia, West Virginia and Ohio, will erect a new cement mill, according to a report, in the vicinity of Martinsburg, W. Va., in connection with its present operations. The plant will have a daily capacity of 1000 bbl., it is said, and will cost in excess of $800,000 with machinery.

J. H. Baker is president of the Standard company; Daniel Baker, Jr., vice-president, and Joseph D. Baker, Jr., treasurer. The company has plants located at Havre de Grace and Dickerson, Md., Martinsburg, Millville, Kearneysville and Keyser, W. Va., Strasburg, Va., and Woodville, Ohio.

William E. Carson Patents Process for Plastic Hydrated Lime

WILLIAM E. CARSON, president of the Riverton Lime Co., Riverton, Va., has drawn upon his long experience in the manufacture of lime to develop and patent a process for the manufacture of a lime hydrate which is both plastic and completely miscible with water to make milk of lime. The following abstract of his patent (U. S. No. 1,613,341) is self-explanatory:

This invention relates to processes of producing hydrated lime; and it comprises as a new article a dry hydrated lime existing as a mass of extremely fine particles, said lime having a plasticity in excess of 200 and being substantially completely miscible with water to make milk of lime of the ordinary properties; and it further comprises a process of slaking lime to produce dry hydrate having a plasticity in excess of 200 wherein quicklime is ground to 100-mesh fineness or finer and the fine ground lime is quickly admixed with a limited amount of water, admixture being completed prior to occurrence of any substantial hydration and the amount of water being such as to give a dry hydrate without a rise in temperature above, say, 150 deg. C.; all as more fully hereinafter set forth and as claimed.

It is the object of the present invention to produce a new type of dry hydrate existing as a mass of extremely fine particles; such mass being substantially completely miscible with water to form lime milk of the ordinary properties; and on mixing with water, giving mortars of even higher grade thon those produced by skilled workmen in wet slaking. This lime will rank as a finishing hydrate since its plasticity is over 200. As a matter of fact, its plasticity is ordinarily over 250.

Fine Grinding an Essential

I reduce the lime to such a size that complete wetting can occur in a time well within the period of incubation; and surround each individual particle with just the amount of water which will wet it, will hydrate it and (by conversion into steam) will allow its temperature to go to 100 deg. C., but not much above. In so doing, although of course actually the same number of heat units is liberated as in slaking coarser lime, yet the impression is that of a cooler slaking—there is no localized or temporary development of high temperatures. With a suitable fine grinding of quicklime and quick admixture of water, the whole mass enters into quick interaction. And by properly proportioning the amount of water so as to furnish that needed for *(a)* hydration and *(b)* that required for cooling by vaporization, the final result is a mass of dry extremely fine-particled hydrate. As the entering water has had no opportunity to exercise any other function than that of hydration and of vaporization, there is no solution or redeposition of the lime particles formed in hydration—they retain their initial extremely fine state of subdivision; the state of subdivision in which CaO is normally left on slaking lime. The particles are in a colloid state and on access of water peptization takes place at once—milk of lime is formed.

The particular state of fineness required with any given lime depends somewhat upon its character and is best determined by a special laboratory test.

Ordinarily, however, I employ lime which will pass at least a 10-mesh sieve (95% through) and it is usually better so that it will pass a 200-mesh. In securing this fineness it is convenient to use mills working upon the air flotation principle. The quantity of water to be used is always just that which will suffice *(a)* for hydration and *(b)* for cooling by vaporization. Neither more nor less is wanted; although in calculating the amount required for cooling, due allowance must be made, of course, for the heat capacity of the apparatus, radiation losses, etc., so that the amount is usually somewhat less than pure theory would indicate.

Water Ratio

The exact amount of water to be used also depends upon the actual CaO present. The ideal amount of water for my purposes, as regards the amount of actual CaO present, is in the ratio of 1 part CaO and 0.724 parts H_2O at the ordinary temperature, say, 20 deg. C. Such a mixture initially contain 58% CaO and 42% H_2O. This is, however, under, so to speak, adiabatic conditions where heat losses, other than those due to volatization of H_2O, are not involved. Under ideal conditions, this amount of water will complete the slaking without a rise in temperature over 100-105 deg. C. and give a hydrate of extreme plasticity; usually above 250.

Temperature Limits

With proper fine ground, high calcium lime and the proper amount of water quickly mixed, that is, with admixture perfected during the period of incubation, the mass merely steams a little and does not go above 105 deg. C. and usually not above 101 deg. C. and gives a perfectly dry product of extreme fineness and plasticity. Higher temperatures even up to 115 deg. C. are permissible but the stated limit of 100-105 deg. C. is better. In the operation just described no opportunity is afforded for solution or redeposition of lime; and the fine particles produced in hydration do not increase in size or agglomerate. The proportion of water which is present for cooling purposes simply steams away, without opportunity for effecting solution or change in particle size.

Laboratory Tests on Limes to Determine Degree of Grinding

The whole point of the invention is getting the lime fine enough so that a quick admixture may be made with it, prior to hydration, of the exact amount of water required to hydrate and to cool (by vaporization) the mixture so that it shall take a temperature usually not over 105 deg. C. and shall give a dry hydrate.

While in practice I always grind the lime as fine as 100-mesh and often go above 200-mesh, these extreme finenesses are not always necessary. With a porous, open-textured lime from particular limerocks or produced by particular methods of calcination, somewhat coarser materials may sometimes be used. The exact fineness required for my purposes with any given lime can be readily determined by what may be termed laboratory duplication of plant procedure. A sample of fine ground lime is mixed with the calculated amount of water in a roomy beaker shielded against cooling. If the lime is fine enough, quiet reaction will take place after an incubation period of perhaps a minute during which the water is penetrating the particles; and the whole wet mass quietly changes to a dry fine-particled body of completely hydrated lime. With material too coarse, there will be localization and violent action, and with the calculated quantity of water, not enough will be present to afford complete hydration—there will be unslaked lime present. The quantity of water used in the beaker test is always somewhat more than that required in actual plant practice; but the difference is usually not great and is readily determined. In one particular plant with a mixing time of one minute and the use of an ordinary pugmill system, for mixing, ordinarily I employ, instead of the stated ratio of 1 : 0.72, about 1 : 0.50. In this particular case the water added, instead of being about 72% of the lime, is about 50%.

Blotter Test

The best of the present dry hydrates withstand the blotter test in the sense that a pulped mass of such hydrated lime and water may be troweled over a blotter; but they do not give up much water to the blotter—during spreading the pulp withstands the suction of the paper. With the present hydrate, however, the pulped mass may be troweled over the blotter and at the same time gives up considerable water to the suction. That is, the present lime takes up enough more water in making a plastic mass, because of its extremely colloid nature, to allow passage of some into the blotter without forfeiting plasticity. This is a property which is extremely convenient in operation, because the mason or plasterer desires some of the underlying layer to be wet in spreading mortar. In this respect the present hydrate is much more advantageous than any of the prior preparations, dry or wet. There is also a difference, and an advantageous one, in the consistence of the troweled mass—it has no graininess, but it is buttery or greasy in consistence.

What I claim is:—

1. The process of producing dry hydrated lime which comprises grinding quicklime to a fineness greater than 100 mesh and quickly admixing said ground lime with an amount of water sufficient to react with all the lime to form a dry hydrate without a rise in temperature above 100-115 deg. C.
2. In the slaking of lime, the process which comprises grinding quicklime to such a fineness that intimate admixture with water can be secured prior to any substantial hydration and quickly admixing said ground lime with an amount of water sufficient to form a dry hydrate and to produce a temperature between 100 and 115 deg. C.
3. In the slaking of lime, the process which comprises grinding quicklime to such a fineness that intimate admixture with water can be secured prior to any substantial hydration and quickly admixing said ground lime with an amount of water sufficient to form a dry hydrate and to produce a temperature not exceeding 115 deg. C.
4. In the manufacture of dry hydrated lime having a plasticity in excess of 200, the process which comprises grinding quicklime to about 100 mesh or finer and quickly mixing said ground lime with an amount of water sufficient to form a dry hydrate and to produce a temperature not exceeding 115 deg. C.

WILLIAM E. CARSON.

Hints and Helps for Superintendents

Prevention and Handling of Misfires

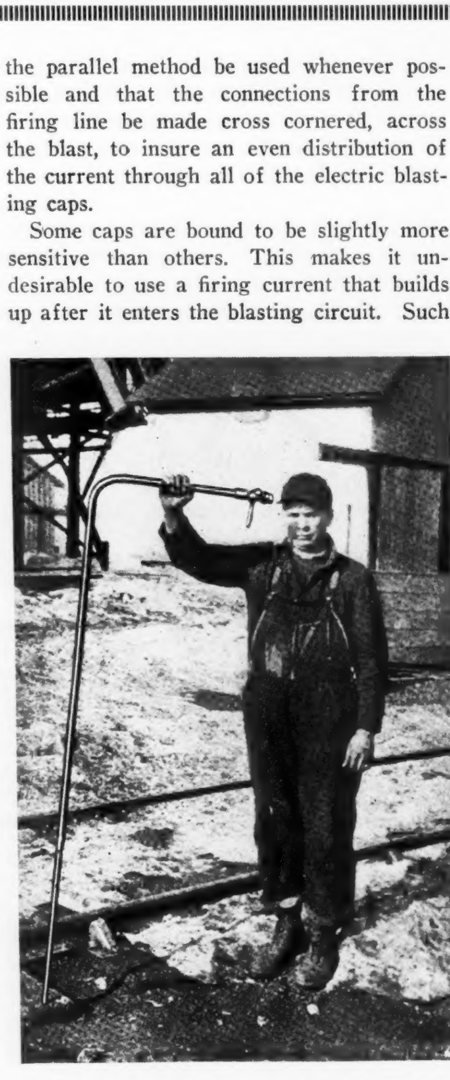
THE danger of misfires is always present in blasting operations and there is no standardized scheme for their elimination. A recent issue of the *Du Pont Magazine* presents an article outlining some of the methods for eliminating this hazard in outside shooting. This is part of a paper prepared by C. S. Hurter, du Pont technical representative for the recent National Safety Congress meeting at Detroit. The data for this discussion was gathered by Du Pont field men throughout the country. Some of the outstanding features of Mr. Hurter's paper are given below in abstract.

The possibility of a misfire is very reduced if more than one detonator is placed in each hole. With electric blastings caps, one set need not be connected in the circuit but simply left as a reserve in case only a limited amount of electric power is available.

A frequent cause of misfires, especially misfires of center holes in a long line, and in particular in the presence of certain earthy salts in the ground water, has been leakage of electric current. The only sure way to prevent misfires where such salts are present in solution is to use electric blasting caps with enameled wires. The enamel on the wire under the cotton winding provides extra insulation.

The problem of current leakage makes it necessary to limit the number of ordinary electric blasting caps that should be connected in one series, regardless of whether the work is wet or dry and of the source and amount of firing current available. One explosive company puts this limit at fifty. Where it is necessary to connect longer lines of electric blasting caps in series, nothing but enameled wire caps should be used, no matter how dry the work may be. The surest method of firing electric blasts is to connect all detonators in parallel and to use a power current. It is advisable that the parallel method be used whenever possible and that the connections from the firing line be made cross cornered, across the blast, to insure an even distribution of the current through all of the electric blasting caps.

Some caps are bound to be slightly more sensitive than others. This makes it undesirable to use a firing current that builds up after it enters the blasting circuit. Such a current is likely to cause the more sensitive caps to explode first and destroy the circuit before the less sensitive ones receive enough current to fire them. There should always be a load on the dynamo that furnishes current for a firing circuit when a blast is about to be shot.



Blow-pipe with brass tip for blowing out tamping from missed hole

This building-up effect in an electric current also has a bearing on the use of alternating current for firing blasts. The shortest interval of time between the application of the firing current and the explosion of an electric blasting cap is 0.014 sec. In the 25-cycle current, the half cycle is 0.02 sec., which is a longer period of time than 0.014 sec. Consequently, there is a possibility that a current of 25 cycles may be thrown into the blasting circuit in such a manner that a building-up effect, similar to that of the dry cell, will take place and will cause a misfire in a series blasting circuit.

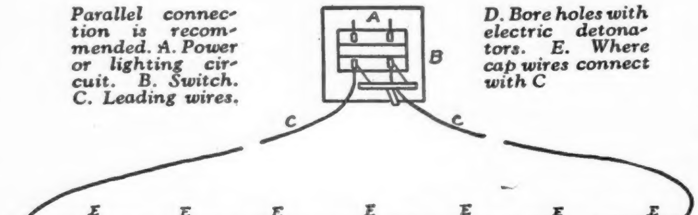
To avoid the possibility of misfires, the crest of the alternation must always pass through a series-connected blasting circuit in 0.014 sec. As the half cycle of the 50-cycle current is 0.01 sec., and of the 60-cycle current 0.0083 sec., which are both less than 0.014 sec., the 50- and 60-cycle alternating currents can be used for firing series circuits with the same assurance as direct current. The 25-cycle current can be used for parallel method of connections with perfect safety.

The handling of misfires is a serious problem. The safest procedure in outside work seems to be always to measure the distance between the top of the charge and the collar of the bore hole, and then, if a hole misfires, to remove the tamping to within a few inches of the charge, load a fresh primer and shoot again. The Oliver Mining Co. in its mines in the Eveleth district of Minnesota uses a blow-pipe with a brass tip for blowing the tamping out by compressed air. One quarry superintendent in the East always measures the distance in his well drill holes and uses a good loam tamping free from grit. If a hole misfires, he takes a sharp-pointed stick of about 1½ in. dia., which he moistens from time to time with water, makes a hole to within a few inches of the top of the charge, loads this with several 1¼x8-in. dynamite cartridges and a fresh primer, and fires the charge. So far this procedure has never failed to pull the missed shot.

Another common rule for handling misfires is to drill a second hole alongside at a safe distance, this distance depending upon the size of the charge in the missed hole, load the second hole and fire by means of an electric blasting machine. This method, however, is not received with favor by a large number of operators because they are never sure of the first hole or the amount of unexploded powder in the muck. Where a missed hole cannot be reached, the greatest care should be taken in working around it until the powder charge can be located and either fired or removed. It is always best to keep the hole drenched with water while the tamping is being removed.

Some companies keep a record of all misfires and classify them as to cause. This has sometimes led to the discovery and correction of improper practices when it was found that an unduly large number of misfires were traceable to a single cause.

Parallel connection is recommended. A. Power or lighting circuit. B. Switch. C. Leading wires.



D. Bore holes with electric detonators. E. Where cap wires connect with C

Parallel method of connecting detonators

Two Gates for Use in Chutes

THE gates shown in the accompanying pictures are described in the *Engineering-News Record,* issue of December 23, 1926. They were used on the bunkers of the Cascade tunnel of the Great Northern Railway in Washington and were designed to control the flow of such a mixture of fine and coarse stone as would come from tunnel blasting. Oftentimes such material is wet and sticky in addition to being of mixed sizes. Both would seem well adapted to use in a bin or chute between the quarry and the primary crusher of a plant.

Both gates are of the finger type and the fingers are of an unusual design. In the larger gate these fingers are made of 60-lb. rail bent and sharpened. When the air hoist, which raises all the fingers together, is released, the sharp points fall into the stream of rock and their weight causes them to work down to the bottom of the chute and effectively shut off the flow. In the cut the fingers shown are set only ¾ in. apart to shut off the flow of the smallest pieces, but in quarry practice it would not be necessary to set them so close. The angle at which the fingers are hung affects the closure. In the cut the fingers are set about 11 deg. more than a line parallel with the chute so that there is some weight to hold the points down when the points are resting on the chute.

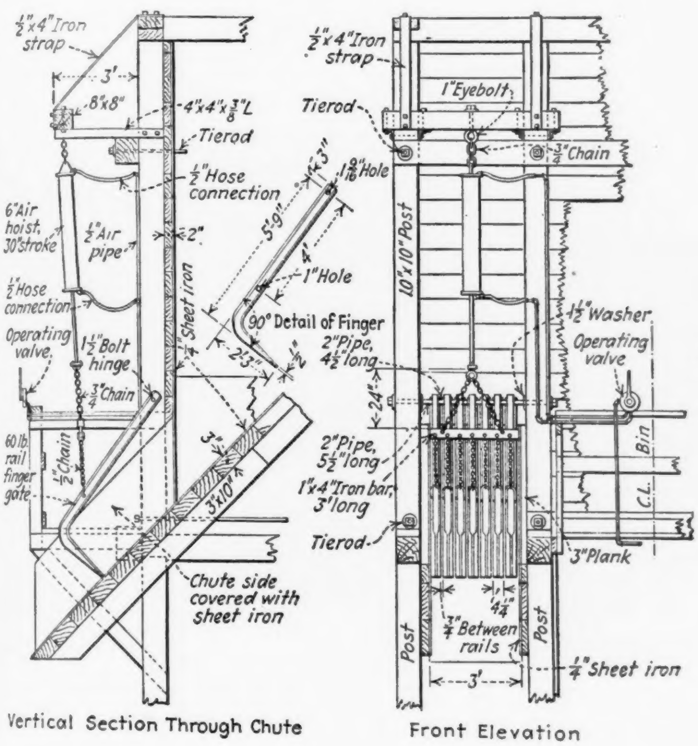
As this gate is worked by a small air hoist, it can be operated from a distance where a man will be out of the way of a stone that happens to jump through when the gate is opened. This is an advantage when the gate is above a crusher.

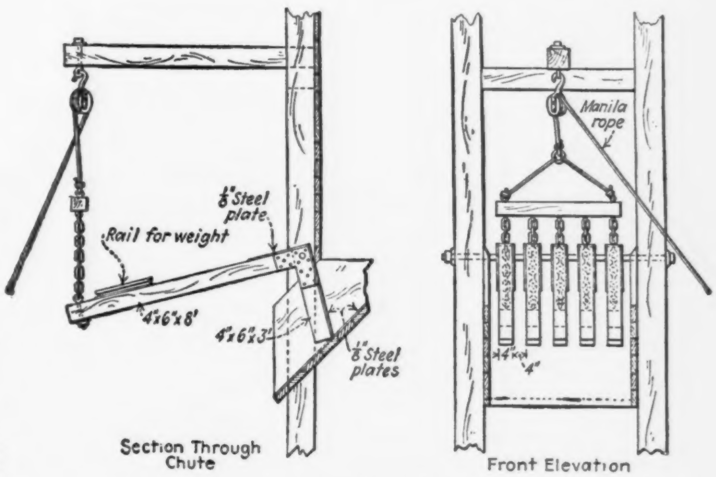
The second form of gate also employs fingers that make a right angle, but a rod passed through the angle makes bell crank levers of them. The long arm is loaded with a piece of rail iron to hold the fingers down. This type of finger will rise when a stone hits it hard enough, as the ordinary straight finger does.

The opening and closing device is a bridle beam, connected with chains to the fingers, which is raised and lowered by a block and tackle. This, like the other gate, can be opened and closed from the side.

Both gates are said to have worked well in practice, and a general knowledge of gates leads one to believe that they would be quite as satisfactory as the usual straight finger type. Neither would be very expensive to construct.

An obvious improvement on the simple form would be to make the fingers of rail bent to a right angle. The rod could be passed through a bit of pipe that was welded into the rail.

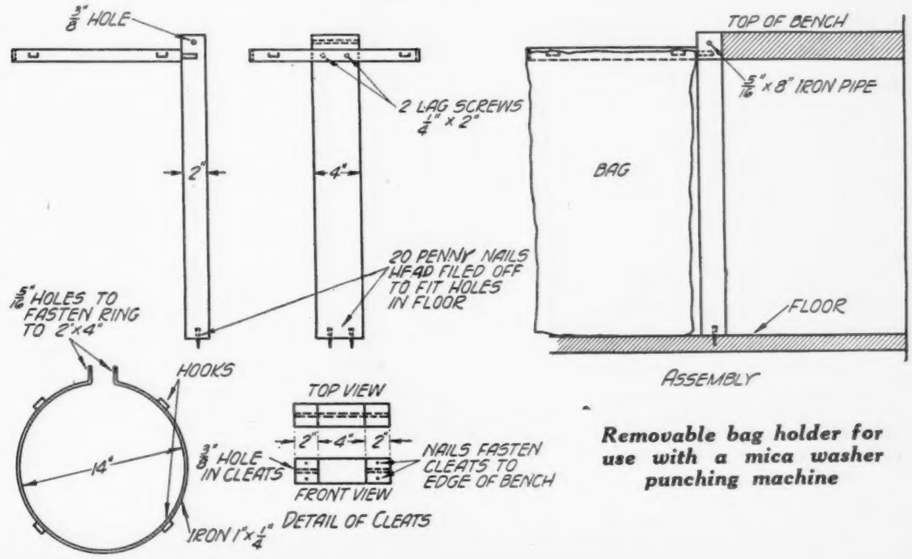




The left-hand picture shows an elaborate form of gate with air hoist. The right is a simple form operated by hand through a block and tackle which appears better than the straight finger gate

Removable Bench Bag Holder

THE illustrations accompanying this article shows the method used by H. N. Kirk, Keene, N. H., in the construction of a removable bench bag holder. This is used at the right hand of a large mica washer press for the collection of scrap mica remaining after large size washers have been stamped from the stock. The bag when filled is tied and removed. The best of the scrap may be used for small washers when needed. The holder can be fastened to the side of the wall if desired and moved from one machine to another. When not in use the bag can be hung up out of the way. The iron ring to which the bag is fastened may be placed at any angle to suit the user. Making the side next to the press operator about 3 in. lower helps the operator to hit the inside of the bag more easily.



Removable bag holder for use with a mica washer punching machine

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Alpha Portland Cement Co. (common)[2] new stock	Feb. 1	No par	39	41	75c Jan. 15
Alpha Portland Cement Co. (preferred)[2]	Feb. 1	100	115	....	1¾% quar. Mar. 1
Arundel Corporation (sand and gravel—new stock)	Feb. 2	No par	31¾	31⅞	45c qu., 20c ex. Jan. 3
Atlantic Gypsum Products Corp. (1st 6's carrying 10 sh. com.)[10]	Feb. 2	....	110	....	
Atlas Portland Cement Co. (common)[2]	Feb. 1	No par	41	43	50c qu. Dec. 1, $1 ex. Jan. 12
Atlas Portland Cement Co. (preferred)	....	100	....	....	2% quar. Oct. 1
Atlas Portland Cement Co. (preferred)[2]	Feb. 1	33⅓	43	....	2% quar. Jan. 3
Beaver Portland Cement Co. (1st Mort. 7's)[8]	July 29	100	100	100	
Bessemer Limestone and Cement Co. (common)[4]	Dec. 17	100	135	....	1½% qu.; $4 ex. Dec. 31
Bessemer Limestone and Cement Co. (preferred)[4]	Jan. 13	100	108	109½	1¾% quar. Dec. 31
Bessemer Limestone and Cement Co. (convertible 8% notes)[4]	Dec. 17	100	99	100	8% annual
Boston Sand and Gravel Co. (common)	Jan. 28	100	73	75	1% qu., 2% ex. Jan. 1
Boston Sand and Gravel Co. (preferred)	Jan. 28	....	....	85	1¾% quar. Jan. 1
Boston Sand and Gravel Co. (1st preferred)	Jan. 28	....	....	90	2% quar. Jan. 1
Canada Cement Co., Ltd. (common)	Feb. 2	100	130	....	2% Jan. 4
Canada Cement Co., Ltd. (preferred)[11]	Jan. 31	100	119	122	1¾% quar. Feb. 16
Canada Cement Co., Ltd. (1st 6's, 1929)[11]	Jan. 31	....	101¼	102½	3% semi-annual A&O
Canada Crushed Stone Corp., Ltd. (6½s, 1944)[11]	Jan. 31	100	93	96	
Charles Warner Co. (lime, crushed stone, sand and gravel)	Jan. 31	No par	22½	....	75c Jan. 12
Charles Warner Co. (preferred)	Jan. 31	100	100	104	1¾% quar. Jan. 27
Charles Warner Co. (lime, crushed stone, sand and gravel) 7s, 1929[16]	Jan. 28	100	102½	103½	
Cleveland Stone Co. (new stock)	Feb. 2	....	50	55	50c qu.; 25c ex. Dec. 15
Connecticut Quarries Co. (1st Mortgage 7% bonds)[17]	Jan. 28	100	104	....	
Consolidated Cement Corp. (1st Mort., 6½s, series A)[24]	Feb. 2	100	96	99	
Consolidated Cement Corp. (5 yr. 6½% gold notes)[24]	Feb. 2	100	95	100	
Consumers Rock and Gravel Co. (1st Mort. 7s)[18]	Jan. 27	100	99½	101	
Dewey Portland Cement Co. (1st mort. 6's 1942)[30]	Feb. 2	100	98½	100	
Dolese and Shepard Co. (crushed stone)[7]	Feb. 2	50	95	98	$1.50 Jan. 1, $1.50 ex. Jan. 1
Egyptian Portland Cement Co. 7% pfd.[21]	Jan. 28	....	95	100	1¾% quar. Oct. 1
Egyptian Portland Cement Co. (common)[21]	Jan. 28	....	8	10	40c quar. Oct. 1
Egyptian Portland Cement Co. (warrants)[21]	Jan. 28	....	2	5	
Giant Portland Cement Co. (common)[2]	Feb. 1	50	80	90	
Giant Portland Cement Co. (preferred)[25]	Feb. 1	50	45	50	3½% and 19% ex. Dec. 15
Ideal Cement Co. (common)	Feb. 2	No par	83	86	$1 quar., $1 ex. Dec. 15
Ideal Cement Co. (preferred)[6]	Jan. 30	100	108	110	1¾% quar. Dec. 15
International Cement Corporation (common)	Feb. 2	No par	47⅜	47½	$1 quar. Dec. 31
International Cement Corporation (preferred)[2]	Jan. 30	100	102	104	1¾% quar. Dec. 31
Kelley Island Lime and Transport Co.	Feb. 2	100	129	133	$2 quar., $2 ex. Jan. 2
Lawrence Portland Cement Co.[3]	Jan. 31	100	100	110	2% quar.
Lehigh Portland Cement Co.[6]	Feb. 1	50	95	100	1½% quar.
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1927 to 1931)[13]	Dec. 18	100	98	100	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1931 to 1935)[13]	Dec. 18	100	97	98½	
Marblehead Lime Co. (1st Mort. 7's)[14]	Jan. 28	100	100	....	
Marblehead Lime Co. (5½% notes)[14]	Jan. 28	100	99	100	
Michigan Limestone and Chemical Co. (common)[6]	Feb. 1	....	26	....	
Michigan Limestone and Chemical Co. (preferred)[6]	Feb. 1	....	24	26	1¾% quar. July 15
Missouri Portland Cement Co.	Feb. 2	25	51	51	50c Feb. 1
Monolith Portland Cement Co. (common)[9]	Jan. 27	....	12¼	12¾	8% ann. Jan. 2
Monolith Portland Cement Co. (units)[9]	Jan. 27	....	30¾	32¼	
Monolith Portland Cement Co. (preferred)[9]	Jan. 27	....	9¼	9¾	
Nazareth Cement Co.[26]	Jan. 28	No par	33½	35	75c quar. Apr. 1
Newaygo Portland Cement Co.[1]	Jan. 28	....	120	....	
New England Lime Co. (Series A, preferred)[14]	Jan. 28	100	....	95	
New England Lime Co. (Series B, preferred)[22]	Jan. 31	100	94	....	
New England Lime Co. (V.T.C.)[22]	Jan. 31	....	35	36	
New England Lime Co. (6s, 1935)[14]	Jan. 28	100	99	101	
North American Cement Corp. 6½s 1940 (with warrants)	Feb. 2	100	93	93	
North American Cement Corp. (units of 1 sh. pfd. plus ½ sh. common)[19]	Aug. 14	....	94	99	2 mo. period at rate of 7%
North American Cement Corp. (common)[19]	Nov. 8	....	20	22	
North American Cement Corp. (preferred)	Jan. 28	....	....	....	1.75 quar. Feb. 1
North Shore Material Co. (1st Mort. 6's)[15]	Feb. 2	100	98	100	
Pacific Portland Cement Co., Consolidated[5]	Jan. 28	100	62½	65	25c mo.
Pacific Portland Cement Co., Consolidated (secured serial gold notes)[5]	Jan. 28	100	96½	....	3% semi-annual Oct. 15
Peerless Portland Cement Co.[1]	Jan. 28	10	5¼	6	
Pennsylvania-Dixie Cement Corp. (1st Mort. 6's)[29]	Feb. 2	100	100	100	
Pennsylvania-Dixie Cement Corp. (preferred)[28]	Feb. 2	100	99	....	1¾% Dec. 15
Pennsylvania-Dixie Cement Corp. (common)[28]	Feb. 2	....	36¼	37	80c Jan. 1
Petoskey Portland Cement Co.[1]	Feb. 2	10	9½	10	1½% quar.
Pittsfield Lime and Stone Co.[31]	Jan. 28	....	....	100	
Pittsfield Lime and Stone Co.[31] (common)	Jan. 28	....	....	25	
Rockland and Rockport Lime Corp. (1st preferred)[10]	Jan. 28	100	103	104	3½% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (2nd preferred)[10]	Jan. 28	100	60	....	3% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (common)[10]	Jan. 28	No par	50	52	1½% quar. Nov. 2
Sandusky Cement Co. (common)[1]	Feb. 2	100	119	125	$2 qu., $4 ex. Jan. 1
Santa Cruz Portland Cement Co. (bonds)[5]	Jan. 28	....	106	110	6% annual
Santa Cruz Portland Cement Co. (common)[5]	Jan. 28	....	....	80	$1 quar., $1 ex. Jan. 1
Schumacher Wallboard Corp. (common)	Jan. 14	....	23⅝	23¾	
Schumacher Wallboard Corp. (preferred)	Jan. 14	....	27	....	
Superior Portland Cement, Inc. (Class A)[20]	Jan. 13	....	45	45½	
Superior Portland Cement, Inc. (Class B)[20]	Jan. 13	....	22	23	
United Fuel and Supply Co. (sand and gravel) 1st Mort. 6s[27]	Jan. 28	100	98	100	
United Fuel and Supply Co. (sand and gravel) 6% gold notes[27]	Jan. 28	100	98	100	
United States Gypsum Co. (common)	Feb. 2	20	103½	104½	2% quar., $1.40 and 35% stk. ex. Dec. 31
United States Gypsum Co. (preferred)	Feb. 2	100	115½	116	1¾% quar. Dec. 31
Universal Gypsum Co. (common)[3]	Feb. 2	No par	6	7	
Universal Gypsum V.T.C.[3]	Feb. 2	No par	6½	7	
Universal Gypsum Co. (preferred)[3]	Nov. 23	....	73	77	1½% Feb. 15
Universal Gypsum and Lime Co. (1st 6's, 1946)[3]	Feb. 2	100	....	96	
Union Rock Co. (7% serial gold bonds)[18]	Jan. 27	100	99	101	
Wisconsin Lime and Cement Co. (1st Mort. 6s, 1940)[15]	Feb. 2	100	98	100	
Wolverine Portland Cement Co.	Feb. 2	10	5½	6	1½% Feb. 15

[1]Quotations by Watling, Lerchen & Co., Detroit, Mich. [2]Quotations by Bristol & Willett, New York. [3]Quotations by True, Webber & Co., Chicago. [4]Quotations by Butler, Beading & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by Ralph Schneeloch Co., Portland, Ore. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee, Higginson & Co., Boston and Chicago. [11]Nesbitt, Thomson & Co., Montreal, Canada. [12]E. B. Merritt & Co., Inc., Bridgeport, Conn. [13]Peters Trust Co., Omaha, Neb. [14]Second Ward Securities Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois, Chicago. [16]J. S. Wilson Jr. Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hemphill, Noyes & Co., New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., New York. [22]William C. Simons, Inc., Springfield, Mass. [23]Blair & Co., New York and Chicago. [24]A. B. Leach and Co., Inc., Chicago. [25]A. C. Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [27]J. G. White and Co., New York. [28]Mitchell-Hutchins Co., Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago. [30]McIntyre & Co., New York, N. Y.

QUOTATIONS ON INACTIVE ROCK PRODUCTS CORPORATION SECURITIES ON PAGE 74

Editorial Comment

Railway-Rate Ammunition

The paper read by Edwin Brooker, traffic counsel, Washington, D. C., before the recent annual convention of the National Sand and Gravel Association at Cincinnati, Ohio, and published in ROCK PRODUCTS, January 22, pp. 71-75, is undoubtedly one of the most valuable and practical contributions made to the mineral aggregate industry in a long time. It is especially interesting and valuable to the industry at this time, because, on the same day it was delivered at Cincinnati, the Interstate Commerce Commission was holding, in Kansas City, the first of its public hearings under the now famous Hoch-Smith Act (I. C. C. No. 17000), which involves an investigation of the whole basic rate structure, with the purpose in mind of reducing the level of rates on agricultural products.

Every producer who ships by rail should thoroughly familiarize himself with the logical and forceful presentation of the transportation characteristics of his commodity as set forth so ably by Mr. Brooker, and should lose no opportunity of presenting these arguments on all occasions, not only in his conferences, talks and correspondence with railway officials, but whenever an opportunity exists, to his customers and to the general public. In good time the industry will have an opportunity of presenting these same facts to the Interstate Commerce Commission, which we trust it will do most effectively and with a united front.

If no other result is accomplished than to prevent a more undue burden being saddled on these commodities than exists at present, aggregate producers may well be satisfied with accomplishments. For if the railways are to remain prosperous and continue to spend money with rock products producers they must have adequate revenues. What they lose in one way they must make up in another. And the strength of Mr. Brooker's argument is that not only are present railway earnings from mineral aggregate traffic greater proportionally than on other commodities, but the railways can actually increase their earnings from this traffic by lowering rates and increasing the length of haul.

Bright Outlook for Railway Business

The railroads of the United States will probably spend between $825,000,000 to $925,000,000 during the current year for new equipment, and additions and improvements to their properties, according to information now available. This estimate does not include current repairs and the necessary maintenance work for 1927. Of this total of about $900,000,000, some 60%, or better than $500,000,000, will be spent for roadway, structures, or fixed properties.

During the year 1926 more new railway mileage was built than in any year in the last decade. According to what is considered to be reliable information, construction of this character will be continued this year at a still faster rate. It is expected that the railroads as a whole will spend more than $75,000,000 during 1927 for the construction of more than 1000 miles of new line.

The budget this year also contemplates a considerable amount of second track construction. It is estimated that 600 miles of second and other multiple main tracks will be constructed at an expenditure of more than $50,000,000 dollars. New and enlarged freight classification yards will take something like $60,000,000; about $10,000,000 will be spent for passenger stations and $15,000,000 for freight stations, a total of $85,000,000 for new terminal facilities. Estimates call for a $25,-000,000 expenditure for shops.

The separation of grades within the limits of cities and also in the open country is another important roadway facility for which increasing demands are being made from year to year. Nearly $50,000,000 will be spent for this purpose alone during 1927.

The roads are expected to spend approximately $100,-000,000 for a wide variety of miscellaneous improvements, such as new and heavier bridges, modern water stations and water-treating plants, elevators, reconstruction of tunnels, improvements to coal and freight yards, warehouse and storehouse facilities, etc.

All this is certainly very gratifying news to producers of rock products, and doubtless assures many individual producers of a year of large demand and record production. Prosperity of the railways is directly related to the prosperity of many industries from which they buy.

The Growth of Rock Products

Recent census estimates indicate that the population of the United States has increased 12½% since 1920. Farm products have increased in a slightly higher proportion, 14% for animal products and 17% for other agricultural staples. Mineral production has increased 42%. If the rock products industry were to be particularized it would show a very high percentage of increase. For example, the concrete materials, cement and the principal aggregates, have made over 100% increase in the period given. It appears that we have learned to feed ourselves with a much less expenditure of energy than was formerly used and are putting more of our energy into building permanent structures, which all civilizations which have preceded this have done.

QUOTATIONS OF INACTIVE ROCK PRODUCTS SECURITIES

Stock	Date	Par	Price bid	Price asked	Dividend rate
Atlanta Shope Brick and Tile Co.[1]	Nov. 24	....	25c	....	
Benedict Stone Corp. (cast-stone) (50 sh. pfd. and 390 sh. com.)[1]	Dec. 29	....	$400 for the lot	....	
Coplay Cement Mfg. Co. (common) (4)	Dec. 16	....	12½	....	
Coplay Cement Mfg. Co. (preferred) (1)	Dec. 30	....	70	....	
Eastern Brick Corp. 7% cu. pfd.) (1)	Dec. 9	10	40c	....	
Eastern Brick Corp. (sand lime brick) (common) (1)	Dec. 9	10	40c	....	
Edison Portland Cement Co. (common)[4]	Sept. 11	50	20c	....	
Edison Portland Cement Co. (preferred)	Nov. 3	50	17½c(x)	....	
International Portland Cement Co., Ltd. (preferred)	Mar. 1	....	30	45	
Globe Phospate Co. ($10,000 1st mtg. bonds, $169.80 per $1000 paid on prin.)	Dec. 22	....	$50 for the lot	....	
Iroquois Sand & Gravel Co., Ltd. (2 sh. com. and 3 sh. pfd.) (1)	Mar. 17	....	**$12 for the lot**	....	
Limestone Products Corp. (150 sh. pfd., $50 par, and 150 sh. com., no par)	Dec. 22	....	$60 for the lot	....	
Missouri Portland Cement Co. (serial bonds)	Dec. 31	....	104¾	104¾	3¼% semi-annual
Olympic Portland Cement Co. (g)	Oct. 13	....	....	£1⅝	
Phosphate Mining Co. (1)	Nov. 24	....	1	....	
River Feldspar and Milling Co. (50 sh. com. and 50 sh. pfd.) (1)	June 23	....	$200 for the lot		
Rockport Granite Co. (1st 6's, 1934)[2]	Aug. 31	....	90	....	
Simbroco Stone Co. (pfd.)	Dec. 12	....	....	....	$2 Jan. 1
Southern Phosphate Corp.[6]	Sept. 15	....	1¼	....	
Tidewater Portland Cement Co. (3000 sh. com.)	Dec. 22	....	$6525 for the lot	....	
Vermont Milling Products Co. (slate granules) 22 sh. com. and 12 sh. pfd. (6)	Nov. 3	....	$1 for the lot	....	
Wabash Portland Cement Co.[1]	Aug. 3	50	60	100	
Winchester Brick Co. (preferred) (sand lime brick) (5)	Dec. 16	....	10c	....	

(g) Neidecker and Co., Ltd., London, England. (1) Price obtained at auction by Adrian H. Muller & Sons, New York. (2) Price obtained at auction by R. L. Day and Co., Boston. (3) Price obtained at auction by Weilepp-Bruton and Co., Baltimore, Md. (4) Price obtained at auction by Barnes and Lofland, Philadelphia, Pa. (5) Price obtained at auction for lot of 50 shares by R. L. Day and Co., Boston, Mass. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on November 3, 1925. (6) Price obtained at auction by Wise, Hobbs and Arnold, Boston, Mass.

New York Trap Rock Debentures Offered

WILLIAM R. COMPTON & CO., E. H. Rollins & Sons are offering a new issue of $1,250,000 New York Trap Rock Corp. ten-year 7% sinking fund gold debentures, due December 1, 1936, and priced at 100 and interest, yielding 7%. Proceeds from this issue of debentures and from $6,500,000 of first mortgage sinking fund gold bonds recently sold will be used to purchase the physical assets of the Tomkins Cove Stone Co. and the crushed stone business of the Calvin Tomkins Co., to retire the present funded indebtedness of the corporation, and for general corporate purposes.

Under terms of the issue, a sinking fund sufficient to retire over 95% of this issue on or before maturity will provide $125,000 annually, with semi-annual payments of $62,500 beginning June 1, 1927.

Details of the initial offering of $6,500,000, 6% sinking fund gold bonds of the company were published in ROCK PRODUCTS, January 8, 1927, issue, and include the condensed balance sheet of the consolidated company.

International Cement Earnings Good in 1926

THE past year proved satisfactory for the International Cement Corp., with net income estimated in usually well-informed circles at a new high level for the fourth consecutive year. While year-end charges and revisions may necessitate some changes, it is believed that net income for the year will total between $4,200,000 and $4,300,000, equal after preferred dividends to between $6.25 and $6.40 a share on the 562,500 common shares outstanding. In the year ended December 31, 1925, the company reported net income of $3,976,300, equal to $7.04 a share after preferred dividends on the 500,000 common shares then outstanding.

Officials of International Cement expect a normal and, on the whole, satisfactory year in 1927. Orders are in excess of those at this time last year, and should the present showing be maintained throughout the first quarter, results for that period would be ahead of last year. The New Orleans plant will soon be finished and will open a new geographical center for International. Favorable reports are heard from the foreign subsidiaries, which are operating at near capacity. International Cement has a four-year contract with the Cuban government covering an extensive program of public improvements which will probably call for substantially over 2,000,000 bbl. of cement.

International Cement has nearly concluded its building program, which brings annual production up to 14,000,000 bbl. and gives the company 11 modern equipped plants, serving a market comprising the larger part of the eastern half of the United States, and the countries of Cuba, Argentina and Uruguay. This program has been financed partly through earnings and partly through the issuance of additional preferred and common stock. With the increased facilities net income continues to show substantial increases each year, although the increased capitalization accounts for somewhat lower per share earnings in 1925 and 1926.

Net working capital, according to the report of August 31, 1926, showed in the first seven months of 1926 an increase of nearly $2,000,000 over the annual report for 1925 and stood at $5,746,400. Cash in the same period increased over $1,500,000, to $2,097,800. The company is free of bank loans and funded debt.—*New York Wall Street News.*

Standard Slag Completes Purchase of Bessemer Company

ACCORDING to an announcement in the Cleveland, Ohio, *Plain Dealer,* the purchase of the Bessemer Limestone and Cement Co. by the Standard Slag Co. has been completed. The terms of the sale were essentially as reported in ROCK PRODUCTS, January 8 issue, at which time John Tod, president of the Bessemer company, in a circular letter to the common stockholders asked their acceptance of an offer of $250 per share for their holdings; the preferred stock to be retired at $110 per share.

The Standard Slag Co. after acquisition of the Bessemer Limestone and Cement Co. will have a capacity of about 3,000,000 bbl. annually at the start. This is expected to be further expanded. The Bessemer unit at Bessemer, Penn., has a capacity of about 1,750,00 bbl. and the one building at Buffalo 1,250,000 bbl. Ultimately it is expected that the company will build a plant at Sparrows Point, Md., probably in connection with new slag reducing plant of the Maryland Slag Co., a subsidiary of the Standard company.

This new crushing plant when completed will be the largest of its kind in the country with capacity for reducing 3000 tons of slag every 10 hours. It is estimated Bethlehem Steel Co. blast furnaces at Sparrows Point will produce, when operating normally, 600,000 tons of slag annually, and a slag plant was built to provide for future expansion in blast furnace capacity there.

Standard Slag, with its two subsidiaries, Buffalo Slag Co. and Maryland Slag Co., has capacity for reducing upward of 4,000,000 tons of slag annually. In manufacture of cement the company will use slag to a large extent, replacing limestone.

L. A. Beeghly and W. E. Bliss, president and vice-president respectively of the Standard Slag Co., are the dominant interests in the deal. Their Standard Slag Co. operates 16 blast furnace slag crushing plants and in addition its leading stockholders control the Buffalo and Sparrows Point units which, however, are not corporately related to Standard.

Details of the taking over of the Bessemer property have not been officially announced. It is known though that a Delaware corporation, the Bessemer Limestone and Cement Co., has been incorporated for $16,800,000 and a stock issue expected within a short time.

Bankers' View of the American Portland Cement Industry

"THE always generous surplus of capacity above requirements does not seem to denote a very close adjustment between supply and demand," says the February issue of Commerce Monthly, the National Bank of Commerce review, in a discussion of the American portland cement industry. It holds that substantial additions to existing capacity will bring on excessively competitive conditions and a necessary readjustment period. The bank comment in part follows:

"As a matter of fact, certain characteristics inherent in the industry make it peculiarly subject to overexpansion. The product is heavy and bulky, while its value is relatively low. Freight rates, therefore, are an important element in cost to consumers, and in relatively distant markets they form a protective barrier that becomes a powerful incentive to the establishment of local plants. Thus, with an almost universal occurrence of suitable raw materials the course of cement manufacture has been marked by progressive geographic decentralization. For the industry as a whole the final result is a certain amount of unused capacity, since it may be stated as a general rule that all parts of the country are never uniformly prosperous at once.

"This tendency toward excess capacity is accentuated by the pronounced seasonal movement of demand. Road building generally comes to a stop in the winter months and building activity slows down. The problem presented by the greater requirements in the good weather months resolves itself into striking a balance between equipment enough to handle the entire peak demand and building up sufficient stocks in the off season to care for any possible developments. As cement, through its liability to damage from moisture, requires expensive storage facilities, and there is a certain market risk in building up large stocks, the solution has seemed to lie in normally maintaining some excess equipment to handle a part of the peak requirements. Under these conditions a surplus of potential output over actual production is not an abnormal state of affairs. In the past, demand engaging in the neighborhood of 85% of the facilities available has sufficed to raise prices and attract imports.

"The average of all building materials and the all-commodity index have both declined a third since 1920. Cement prices have declined only 10%. It is true that the cement index did not show so marked a rise before 1920, and with 1913 prices as the base, it is now in line with other building materials. It does not appear likely that there will be continued large increases in cement consumption in the next few years. The requirements of the country, however, should approximate the levels lately attained, unless unfavorable developments in business interfere. Demand, as illustrated by the total shipments in 1926, is sufficient to engage the estimated facilities at the end of this year to about 81% of capacity. Additional equipment to be ready in 1927 will reduce the rate of operation to between 75% and 80%. It is apparent, therefore, that if prosperous conditions are to be maintained in the industry, and if a return to excessively competitive conditions is to be avoided, it is imperative to slacken the rate at which capacity to produce is being enlarged."—*New York Journal of Commerce.*

Price Reductions in Portland Cement

VARIOUS Eastern newspapers have carried the following item (January 17), which we have verified so far as possible:

"The International Cement Corp. has cut prices of portland cement 30c a barrel in the Boston zone, while Universal Portland Cement Co. has reduced its Hudson River base price to $1.75 a barrel from $1.95."

In announcing this reduction, H. Struckmann, president of the International Cement Corp., is credited with the accompanying statement:

"It is estimated that total shipments in 1926 by American cement plants reached a total of 162,000,000 bbl., as compared with 157,000,000 bbl. in 1925," said Mr. Struckmann. "Actual production in 1926 was 4½% in excess of 1925 and cement producing facilities practically completed will add 10,250,000 bbl. to the total. This indicates a surplus over 1926 consumption of approximately 17,000,000 bbl. of cement. In considering the significance of these figures it should be remembered that a great number of mills in certain sections of the country operated on a curtailed production basis during much of the year, due to market conditions. This curtailment was due to the lack of demand."

Local Overproduction

Mr. Struckmann pointed out that one of the things for which investors in cement securities must be watchful is the possibility of localized overproduction. "Every investor," said Mr. Struckmann, "must scrutinize with great care the relationship between the productive capacity of cement mills already available in a given territory, as compared with present and prospective consumption in that territory. He cannot take it for granted that every new mill which poorly advised capital may choose to erect will bring fair returns on actual investment.

"The necessity of protecting itself against injudicious construction of competing cement mills was one of the factors which influenced the formation by the International Cement Corp. of a chain of cement mills, no two of which are subject to the same local competitive conditions. The opinion is generally held that, while the cement industry as a whole is in a healthy condition and consumption is well maintained, any localized condition where production is increasing without due regard to consumption must be watched very carefully, if such localities are to avoid a repetition of what some territories went through in the period 1910-15, when a large number passed through receiverships, causing loss of millions of dollars.

1926 Consumption

"A total of approximately 45,000,000 bbl. of cement was used in 1926 for paving and highways; 43,000,000 bbl. in public and commercial buildings; 30,000,000 bbl. in small town and farm uses; 14,000,000 bbl. in houses, exclusive of rural; 9,000,000 bbl. in sidewalks and private driveways; 9,000,000 bbl. by the railroads for various purposes; 7,500,000 bbl. in concrete pipe for water, sewers, irrigation and culverts, and 5,000,000 bbl. for bridges, river and harbor work, dams and water power projects, storage tanks and reservoirs. The remainder of the total output was utilized in more than 100 miscellaneous uses."

Ideal Cement Holds Annual Meeting

THE annual meeting of the stockholders of the Ideal Cement Co. was held recently in Denver, Colo. The annual report was absent, but it was declared that the sales for 1926 were in excess of the previous year; earnings proportionately increased. The new plant near Fort Collins, which is right in a natural gas field, will be hurried to completion.

The board of directors and officers elected are: Charles Boettcher, president; Claude K. Boettcher, vice-president; Harry C. James, vice-president and treasurer; R. J. Morse, vice-president and secretary; James B. Grant, James Q. Newton and R. S. Gast.

Hardstone Brick Co. Building Three-Press Plant

CONSTRUCTION work on the new three-press sand-lime brick plant which the Hardstone Brick Co. is building at Pacific, Mo., has been started. Equipment will be supplied by Rohrig and Konig, Magdeburg, Germany.

Celite and Feather-Stone Adjust Difficulties

THE recent litigation settlement between the Celite Co., Los Angeles, Calif., and the Feather-Stone Insulation Co., Los Angeles, has been the basis for several erroneous rumors, among them being one that a consolidation of the two companies had been completed. A report to this effect, taken from the Lompoc, Calif., *Review,* was published in ROCK PRODUCTS, January 8 issue, and since that time has been declared by officials of the companies concerned to be incorrect, inasmuch as the Feather-Stone Co. has only obtained the licensed rights to manufacture certain insulation products from the Celite Co.

Detroit Convention of the Sand-Lime Brick Association

Visit Plants in Locality That Produce About a Fourth of All Sand-Lime Brick Made in the United States

THE twenty-third annual convention of the Sand-Lime Brick Association in Detroit, Mich., February 1 to 3, was the best attended in the history of the industry—in keeping with production during the past year, which was the greatest in the history of the industry—approximately 400,000,000 brick. Of these 400,000,000 sand-lime brick about 100,000,000 were produced in the vicinity of Detroit, and one of the most interesting and instructive features of the convention was a half-day spent in visiting some of the Detroit plants.

Should Take More Interest in Government

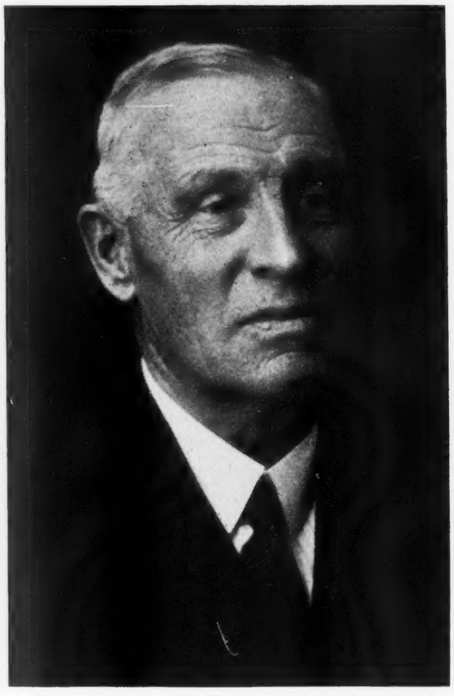
J. L. Lovett, of the Michigan Manufacturers Association, in his opening address stressed the importance of manufacturers and business men taking a more active part in state and municipal government. He discussed in some detail the Michigan state legislative situation, which is similiar to that of most other states, and described the pressure being brought to bear to pass new legislation covering workmen's compensation, minimum wage, new tax measures, etc., which very vitally affect the profit-making possibilities of manufacturing enterprises. The only way to meet these conditions was for business men generally to take a more active part in politics.

Progress in the Industry

In a brief address President John L. Jackson sketched some of the important developments in the industry in 1926. During the year Mr. Jackson personally visited the plants of a majority of the members and he made interesting and pertinent remarks on his observations. He was particularly interested in knowing how many were making the standard size brick ($2\frac{1}{2}$x$3\frac{3}{4}$x$8\frac{1}{4}$) recommended by the Simplified Practice Division of the Department of Commerce. Apparently about three-fourths of the producers are now making brick this size or very close to it.

President Jackson also emphasized the necessity of more accurate cost-keeping and more attention to costs generally. He thought from his observations of the industry there were ways of reducing costs that were being overlooked. Many industries, he said, had reported marked increases in the efficiency of labor during the last few years; did sand-lime brick manufacturers know if they are sharing in this increased efficiency? There were, he said, many ways in which waste could be eliminated, and more of value obtained from equipment and labor.

The year 1926, President Jackson said, was the best in the history of the sand-lime brick industry. He did not seem to think 1927 would be quite so good. He thought the use of brick as a building material was being hindered by lack of co-operation between common clay brick manufacturers and sand-lime brick manufacturers. He closed his address by announcing six new members of the association.



John R. Jackson, president, Sand-Lime Brick Association

The report of the secretary and treasurer, G. W. Phelps, showed a cash balance on hand of over $500—the healthiest condition the association has ever been in.

Educational Work

J. M. Porter, U. S. Bureau of Standards, Washington, D. C., reported for the committee on education and simplified practice. He has collected statistics from the industry recently which show that 61½% of the total production of sand-lime brick now conforms to the recommended standard size brick.

Operating Data

Most of the discussions on operating problems will have to be deferred to a later issue, but some interesting details were brought out in the first two days' sessions. Irwin G. Toepfer, Acme Brick Co., Milwaukee, Wis., said that in making changes at one of his plants recently they had found the heads of the hardening cylinders badly cracked—6 to 18-in-hair cracks extending around the flanging—and he warned other operators to be on the lookout for such failure of the cylinder heads before serious accidents occurred. Some of the heads had been repaired by electric welding.

Mr. Toepfer exhibited and described briefly a sand-lime building block which has been produced at his plants in an experimental way. These blocks were made in a heavy duty stripper-type concrete-block machine. The block fulfilled some of the standard tests very satisfactorily, but could not be produced commercially by any concrete block machine now on the market. A heavier and sturdier machine is needed.

This sand-lime brick block was made of a standard sand-lime-brick mixture and manufactured by the same process as sand-lime brick. It was lighter than the same size block made of concrete, but heavier than a cinder concrete block. It was found to meet the standard compression test for a concrete block, but not the absorption test. Absorption was 6½% for a similar concrete block and 17.6% for the sand-lime block. Tested for water tightness by the penetration method, the penetration of the concrete block in 24 hours was 4½ in. compared to 5 in. for the sand-lime block.

Mr. Toepfer was not in favor of hollow sand-lime brick as manufactured in Europe. He thought the extra cost of manufacture and the additional breakage in handling would more than make up for any saving in materials. The hollow brick, under the Wisconsin railway commission's definition of brick, would also have to carry a higher freight rate.

Washing his sand, in spite of the difficulties involved, Mr. Toepfer said, had proved profitable through making a better quality product, and by increasing the output of his presses. The washed sand was run through the rod mill twice in order to provide the necessary fines.

More Sand-Lime Brick Experiments

J. Morley Zander, Saginaw Brick Co., Saginaw, Mich., described some experience his company had had in making hollow sand-lime building blocks as follows:

"Back in 1924, Mr. Jackson, president of the Saginaw Brick Co., proposed the production of a sand-lime building block, and accordingly experiments were begun. A temporary installation of a hand-operated machine was made in one corner of the factory at Saginaw, Mich., and a few block produced of sand-lime and portland cement, some smooth-faced, some rock-faced and some panel-faced. These blocks were tested and various mixtures tried out. Finally a decision was made to use a straight sand-lime mixture, the same as for brick for the plain-face blocks. For panel-face and rock-face a facing of portland cement and sand was used.

"These experiments with the hand-operated machine were carried on steadily for a considerable time, and the product was sold on the local market. One garage using over 6000 blocks was built in the late fall of 1925, using a panel-face block made entirely of sand and lime, and it makes a very good appearance.

"In the winter of 1925 a power, face-down, block machine was installed and produced about 100,000 blocks in 1926. These were mostly plain-face or common blocks although some panel-face blocks were made for orders that demanded them.

"The making of sand-lime panel faces has been discontinued though no trouble from disintegration was ever experienced. The cement face does not discolor to the same extent nor in the same manner as the sand-lime panel, so it was felt that when blocks are used for facing purposes and the face carries projections, a material that started with a gray color would probably change less than one that was extremely white. This gray color to which the home owner is accustomed is more satisfactory if obtained with cement than by coloring the sand and lime.

"The block product of the Saginaw Brick Co. tests about 1200 lb. per sq. in., which is higher than the city ordinance requires for building blocks, and is much higher than many concrete blocks. The absorption, while higher than the brick, is about 20%, which is low for a building block.

"Standard block machines have been used though some difficulty has been experienced in getting the material to flow readily as a sand-lime mixture is stickier, and has a greater tendency to lodge in narrow places than a cement-sand mixture. It has also been necessary to tamp the sand-lime blocks harder or longer than the sand-cement blocks, and this cuts down the capacity of the machines. So far all of the blocks made have been made on face-down machines, though at the present time a stripper type of machine is being installed.

"So far this machine has not been made to produce satisfactorily, although I believe that for common blocks a stripper type of machine is the most rapid, but it will not produce face blocks, for the blocks are stripped and elevated vertically out of the mold or pocket, much as brick are pushed up out of the pockets.

"The face-down machine, as its name implies, is tamped with the face down and the cores horizontal. To finish this block the back of the block, which is on top, must be troweled off. This is done by the machine, but takes a little time. It is also necessary to pull back the cores, which is also done by the machine, then the block mold is unlatched and opened and the block and pallet rolled over so that the pallet which is on the side, while the block is being tamped, will be underneath in bearing off.

"All of these operations require time and decrease the output, but a greater variety of products can be made on the face-down machine than on the stripper, so it is a good machine for experimental work.

"A hundred blocks uses slightly less material than a thousand brick and generally sell for as much or a little more money. The labor cost of 100 blocks appears to be slightly more than the cost of making 1000 brick though there is not a great difference. The cost of steaming the blocks is higher than the cost of steaming brick, as a smaller tonnage fills the retort. To get the largest possible number of blocks into the retorts a special car with racks is used, but with this car only 61 blocks 8x8x16 fill the same space as 1225 brick.

"It is the intention of the Saginaw Brick Co. to continue the block business, for it takes care of considerable foundation work. Home owners like the clean white basements created by sand-lime blocks, and contractors report them as easily laid as other blocks."

Discussion of Standard Size Brick

H. R. Colwell, of the Simplified Practice Division of the Department of Commerce, furnished a paper, which was read by Mr. Ely, of his staff. It was urged that wider adoption be made of the recommended standard size for brick. This led to quite a lengthy discussion of this standard size in which the point was brought out that in competing with hollow clay tile and concrete block there was no advantage to the manufacturer in reducing the size of his brick, since it only increased the cost of it when laid up in the wall—which is the all-important consideration.

Remarkable Fire Test of Sand-Lime Brick

E. W. Smythe, Wisconsin Brick Co., Madison, Wis., read one of the most interesting and helpful papers at the convention, which we give complete as follows:

"Last spring a sub-committee, dominated by clay brick manufacturers, recommended to the American Society for Testing Materials the following definition for brick: 'A brick is a structural unit rectangular in shape and made of burned clay unless designated by a prefix indicating another material.' The American Society for Testing Materials has not yet acted on this recommendation.

"The clay brick manufacturers immediately published a circular in which the following statements regarding this definition of a brick were made: 'Hereafter a brick will be a brick, just as it has been for many centuries. If it is not made of burned clay, it is not a brick, but is a synthetic product, lacking all the qualities contained in burned clay building units. If a brick comes through the fire it is self-tested and is a sound, honest unit. A brick that is a mixture of ingredients, the quality of which depends upon the skill or caution or the honesty of the man who makes it, is something entirely different.'

"Some months ago we had an inquiry from a nearby porcelain works for common brick to be used in backing up fire brick in the construction of a new porcelain kiln. We submitted samples of our sand-lime brick and there were also two makes of common clay brick competing for this job.

"The engineer who had charge of the construction of the kiln was very particular that a brick be used which was capable of withstanding high temperatures, for although the common brick would not come in direct contact with the fire yet they would be subject to quite a high temperature, as these kilns are fired to a temperature around 2300 deg. F.

"As the engineer was not inclined to take any one's word regarding the best resisting properties of the bricks submitted, it was decided to settle the matter in such a way that there could be no doubt as to which brick was capable of withstanding the highest temperature. One each of the competing bricks were placed in a fire clay box, called a sagger, and after sealing the covers were loaded into a likn which was about to be fired. The kiln was kept under fire for 48 hours and attained a maximum temperature of 2255 deg. F.

"After the kiln had cooled down the saggers were removed and opened. Of the three bricks that went into the kiln only one remained and that was the *SAND-LIME BRICK*. The two clay bricks had melted and spread out in a thin layer over the bottom of the saggers that contained them.

"Let us again quote from the pamphlet published by the clay brick manufacturers. 'If a brick comes through the fire it is self-tested and is a sound, honest unit.'"

Supplementing this interesting bit of evidence of the fireproofness of sand-lime brick, several manufacturers told of experience in using their brick for backing the lining of boilers; in every case sand-lime brick stood almost as well as special refractory brick.

Chance to Co-operate with Lime Industry

G. B. Arthur, general manager of the National Lime Association, Washington, D. C., gave a splendid address on the importance of the sales end of a manufacturing business. He said the National Lime Association stood ready to render every possible service both in the manufacturing and the marketing ends of the sand-lime brick industry. He especially complimented a group of Michigan sand-lime brick manufacturers for a very fine booklet on sand-lime brick, just issued. Mr. Arthur warned sand-lime brick manufacturers to watch the revision of building codes, now generally going on throughout the country, as it is very difficult to change a code once adopted; he had known of codes which were not changed for 50 years.

Don't Take Chances with Fire!

J. J. Gallagher, Winchester Brick Co., Winchester, Mass., described the fire which practically destroyed his plant during 1926, and warned all other manufacturers against carelessness in handling and storing oils, wastes, and other combustibles.

Other papers and discussions will be published in a later issue.

First Lime Symposium at Spring Meeting of Chemical Society

THE increasing importance of lime in industry has awakened the interest of scientific men of the country and as a result a symposium on lime has been included in the program of the American Chemical Society for its spring meeting at Richmond, Va., April 11 to 16.

Three half-day sessions will be devoted to the technical problems involved in the production and use of this material. Men prominent in those industries manufacturing and using lime, and chemists interested in investigational work, will participate in the presentation of papers and in the discussions. The symposium will bring these three groups together for the consideration of questions of mutual interest. Recent developments along all these lines and including specifications and adaptation of equipment will be presented. In addition to lime manufacture the following important consuming industries, among a large number of others, will be represented: Paper, textiles, leather, glass, metallurgy, refractories, alkali, bleach, soap, agriculture, creamery.

A number of subjects of vital interest to all industrialists, scientists and the general public, such as water softening and purification, sewage and sanitation, treatment of trade wastes, etc., will be included. A complete set of abstracts will be published by the National Lime Association in one volume and will be available April 13.

The following recognized authorities in their various lines are included in the list of speakers: P. A. Paulson, Kimberly Clarke Paper Co.; Charles Warner, Charles Warner Co.; J. M. Dorr, The Dorr Co.; A. H. Hooker, Hooker Electrochemical Co.; Professor G. I. McLaughlin, University of Cincinnati; C. P. Hoover, Columbus, Ohio, Water Purification Works; L. F. Warrick, Wisconsin State Board of Health; W. E. Carson, Riverton Lime Co.; Professor G. L. Clark, Massachusetts Institute of Technology; V. J. Azbe, consulting combustion engineer; Professor O. R. Overman, University of Illinois; R. K. Meade, consulting engineer.

J. R. Withrow, head of the department of chemical engineering, Ohio State University, is in charge of preparation for the symposium and will preside.

Quarry Accidents in 1925

THE stone-quarrying industry of the United States employed 91,872 men in 1925, of whom 52,224 worked inside the quarry pits and 39,648 worked at outside plants on such work as stone crushing, rock dressing, manufacture of lime or cement, etc., states the Bureau of Mines, Department of Commerce, in a review of reports received from operators of quarries, covering accidents and employment in that calendar year. Accidents to the employes resulted in the death of 101 men in the quarry pits and 48 men at the outside plants. The death rate for the industry as a whole was 1.78 per thousand men employed (calculated on a standard of 300 working days per man), as compared with 1.63 for the preceding year. Accidents to men working inside the quarry pits resulted in a fatality rate of 2.28 as against 1.90 in 1924. For crushing and other outside plants the rate was 1.22 as against 1.24 in 1924.

Of the 101 fatalities among the men working inside the quarries, 34 were caused by falls or slides of rock or overburden, 20 by explosives, 13 by machinery, 11 by haulage equipment, 8 by falls of persons, and 15 by various other causes such as handling rock, flying rock, electricity, etc. The principal causes of fatalities at the outside plants were machinery, haulage, falls of persons, burns, electricity, and falling objects.

The reports of injuries that did not result fatally included all accidents that incapacitated an employe beyond the day on which the accident occurred. Among the employes inside the quarries 8,722 men were thus injured, representing a rate of 197 injuries per thousand men employed, as compared with 178 in 1924, an increase of about 11%. The main causes of these accidents and the number of men injured by them were: 1,639 by handling rock, 1,267 by flying objects, 912 by haulage, 846 by falls or slides of rock or overburden, 764 by machinery, 462 by falling objects, 436 by drilling and channeling, 410 by falls of persons, 335 by timber or hand tools, and the remainder (less than 300 in each case) by explosives, nails and splinters, burns, electricity, and boiler and air tank explosions.

Non-fatal injuries among employes engaged in stone crushing, rock dressing and other work outside the quarries numbered 5,533, indicating an injury rate of 141 for this group of workers as compared with 171 in 1924, a reduction of about 17%. The principal causes of these accidents and the number of persons injured from each cause were as follows: 1,099 by flying objects, 638 by machinery, 568 by falling objects, 471 by falls of persons, 468 by hand tools, 433 by haulage, 397 by handling rock, 280 by burns, 215 by nails and splinters, 81 by electricity, and the remainder by miscellaneous causes.

The total number of accidents of all kinds during the year was 14,404. Of this number 149 accidents resulted in the death of the injured men, 22 caused permanent total disability, 430 caused permanent partial disability, 2,627 caused temporary disability lasting more than 14 days, and 11,176 caused temporary disability exceeding the remainder of the day of accident but not exceeding 14 days. These deaths and injuries combined, when weighted according to standard methods, represent a loss of time estimated at 1,493,000 man-days, a loss of time equal to about 6% of the total number of man-days worked by all employes during the year. In 1924 the deaths and injuries represented a loss of 1,399,000 man-days, or 5½% of the total man-days worked.

Persons employed at quarries in Pennsylvania outnumbered those employed in any other state. The reports for Pennsylvania showed 18,138 men employed in 1925. Ohio ranked second with 6,620 men. California reported 6,075, Indiana 5,457, Illinois 4,872, Vermont 4,603, and New York 4,390. Other states having as many as 2,000 men employed at quarries were Missouri 3,501, Georgia 2,862, Massachusetts 2,635, Virginia 2,281, Tennessee 2,256, Michigan 2,191, and Wisconsin 2,031.

Ohio River Companies Continue Operations Despite Floods

ACCORDING to official reports received from two companies located in the area affected by the recent floods of the Ohio river, all sand and gravel companies with riverside plants were able to continue operations, even when the river was at its highest point, without loss of time or equipment. The reports came from the E. T. Slider Co. of Louisville, Ky., and the Ohio River Sand and Gravel Co. of Paducah. All precautions possible were taken, however, it was said, to protect equipment which might be covered over with water or floated off.

Effects of Chloride and Metallic Sulphates on Hardening of Sand-Lime Mortars*

By F. Justin-Mueller

THE author made a number of investigations several years ago to determine the suitability of using sand from the seashore, which as is known contains more or less chlorides, for the preparation of mortar and in the manufacture of sand-lime brick. In these tests he employed well-washed and well-dried sea sand and he added certain definite proportions of sodium chloride to the various sample batches that were prepared from these mixtures. In order to lend as comprehensive a character as possible to his investigations, simultaneous tests were carried out with sand-lime mixtures to which certain proportions of metallic sulphates were added. From these experiments the conclusion was reached that not only do metallic sulphates have a favorable action on the hardening of the mortar, but that the presence of sodium chloride in the mixture also exerts in part a favorable influence, and that this influence is felt not only when the mixture contained just sand and lime but also when metallic sulphates were present.

These mixtures were made in proper forms and then exposed to the action of the atmosphere. The mixtures used and results that were obtained in testing the samples are shown in tables I and II, respectively.

TABLE I. COMPARISON OF SAND-LIME MIXTURES CONTAINING ADDED PROPORTIONS OF CHLORIDE AND METALLIC SULPHATES

Number of test	1	2	3	4	5	6	7	8	9
Sea sand, washed	500	500	500	500	500	500	500	500	500 gm.
Hydrated lime, 130 gm. of $Ca(OH)_2$ equals 100 gm. of white CaO	200	200	200	200	200	200	50	50	100 gm.
Magnesium sulphate, ground	0	0	50	50	0	0	0	12	0 gm.
Iron sulphate, ground	0	0	0	0	50	50	0	0	0 gm.
Aluminum sulphate, ground	0	0	0	0	0	0	0	0	6 gm.
Sodium chloride, ground	0	5	0	5	0	5	0	0	0 gm.
Water	150	150	150	150	150	150	50	50	150 ccm.

The proportion of sodium chloride (common salt) that was used in the comparative experiments, 1% in weight of the dry sand, was chosen in all cases because it is more than the average amount of salt that is generally present in sea sand. The percentage of salt in sea sand varies very considerably and may be found to be as low as 0.1% (and in certain cases the proportion is sometimes even less than this amount) and as high as 0.7%, according to whether or not the layer of sand has been washed to a greater or lesser degree by rain water. From the results that are shown above in tabulated form it may be concluded that the presence of salt in sea sand is not a detriment. Quite the contrary, it appears to favor the hardening of the mortar. Samples Nos. 1 and 7 gave the worst results, and these samples, as shown, did not contain any sodium chloride at all. The reason for this is to be assigned to the extreme fineness of the sand itself. The common grades of builders' sand, pit and river sand, gave much better results due to the different size of particles under the same test conditions.

Effects of Sulphates and Chloride on Hardening Properties of Lime Mortar

The addition of sulphates alone or in the presence of small proportions of sodium chloride had the effect of enhancing the hardening properties of the mortar to a marked degree. The most advantageous sulphate from this standpoint appeared to be alumnium sulphate. The action of the latter salt was also tested out in mixtures which were made with the aid of common builders' sand and the favorable effects obtained, as above, were confirmed. The metallic sulphates enter into a complex colloidal system with the hydrated lime, which may be expressed in the following manner for the case of aluminum sulphate:

$$Al_2(SO_4)_3 + 3Ca(OH)_2 + nCa(OH)_2 + nH_2O \leftrightarrows 3CaSO_4 \ldots nH_2O \ldots Al_2(OH)_6 \ldots nH_2O \ldots nCa(OH)_2 \ldots nH_2O.$$

TABLE II. EFFECTS OF ATMOSPHERE ON VARIOUS SAND-LIME MIXTURES CONTAINING VARYING PROPORTIONS OF CHLORIDE AND SULPHATES

Test number	1	2	3	4	5	6	7	8	9
Strength after hardening in dry condition	friable	sharp fracture, partially friable	sharp fracture, not friable	sharp fracture, much harder than 3	same as 3	between 3 and 4	falls into sand	sharp fracture between 2 and 3	sharp fracture,- harder than 4
Comparative index	1	3	6	12	6	9	0	4.5	15

The gel system is arrived at in this case through the intermediate combinations of secondary valencies. This aluminum-lime hydrate gel is in a certain sense similar to that of hydraulic lime (lime-alumina).

Lime hydrate as such is unsuitable for the preparation of mortar, for it must first be converted into a lime hydrate gel by the addition of the requisite proportion of water. If the proportion of water that is added is too small, then the mortar hardens very little or not at all. This can be ascertained from examination of the results in the table for samples 1 and 7 as well as 3 and 8. Lime hydrate gel can be obtained, as is customary with all colloidal formations, with varying proportions of water content. Lime hydrate gels have been prepared by the author from well burnt white lime hydrate powders which contained as much as 91 and 105% of water combined with the gel; i.e., water of hydration. In both instances the gels were prepared with a certain excess of water; in the first case with 93% of water and in the second case with 127% of water. The water that did not combine with the gel was determined by quantitative methods after a 24 hr. period. It is accordingly possible to prepare lime hydrate gels with excess water and then to remove the water which did not enter into combination with the gel. This principle seems to have been known and recognized in an empirical manner for quite a long time in building practice. When white lime is employed in the preparation of mortar this is actually slaked with an excess of water, and the milk of lime mixture that is obtained in this manner is allowed to flow into shallow earth pits in which the water which is not held colloidally by the lime hydrate is absorbed. However, due to the use of hydraulic lime, which is constantly increasing, this procedure is being abandoned.

From a comparison of the results obtained with samples 7 and 8 it is seen that in the presence of metallic hydroxides which easily form gels the hardening of the mortar may be effected with the use of comparatively much smaller amounts of water. The alumina in hydraulic limes acts in a like manner and accomplishes the same results and the lime-alumina hydrate gel which is formed appears to require less water for the formation of the gel than in the case of white lime.

The knowledge that the gel condition of the lime hydrate has an important effect on the hardening of mortar furnishes an insight into the hardening process in the manufacture of lime-sand brick. The lime hydrate which is present in the bricks is converted by the steam in the hardening chambers into active lime hydrate gel, which under high pressure combines with the silica in the sand to form a lime silicate.

*Chemiker Zeitung (1925) 390-1.

Formulas for Computing Economics of Labor-Saving Equipment*

Committee of A. S. M. E. Materials Handling Division Studies Problem of Evaluating Labor Saved by Improved Processes

THE committee appointed by the Executive Committee of the A. S. M. E. Materials Handling Division to consider and recommend rational formulas for computing the economic results, under stated conditions, of the installation of labor—conserving industrial equipment, has submitted the following report for consideration:

The real problem in composing a formula is not one of mathematics, but of economics. Not only should there be added to each dollar expended for improved equipment a suitable incidental amount (in percentage of the capital invested) to cover fixed charges or burden, but also a suitable incidental addition (in percentage) should be made to each dollar's worth of labor saved, as its proportion of "burden" saved. The extent of the expenditure for items accounted as burden will usually bear some fairly proportional relation to the amount of labor performed.

When calculating the cost of the finished product, if an improved process or equipment affects the amount and hence the cost of the "direct labor," then, for the most accurate results, the burden should be applied to labor *saved* at the same rate as labor *used*.

For the purpose of ascertaining the cost of the product, nonproductive labor, as a part of burden, should not be considered as subject to any contingent addition for burden. Yet for certain classes of accounting, particularly where comparative economies are being considered, nonproductive labor may carry all items of burden that are chargeable to direct labor, except that it carries no contingent addition for its own class of indirect labor. It entails superintendence, employes' liability, welfare work, penalties for overtime and holidays, capital for payrolls, housing, heating and lighting, with the incidental maintenance, taxes, depreciation and other charges in the same way as direct labor.

Since a new process must of necessity be considered in comparison with an established process, no "burden" need be considered in respect to the labor used in either case, because the burden charge per unit of labor in one process will offset an equal unit of labor in the other process. The difference in labor required, however, must, in the interest of accuracy, be subject to its appropriate addition for "burden." For this class of cost accounting the cost department of an industry should ascertain the proper percentage to add for burden on both "productive" and "nonproductive" labor.

Handling materials is practically always an important item of cost in manufacturing. With complex product it would be difficult to charge handling costs to individual materials; and it is usually accounted as "nonproductive" labor and distributed to various items of product, through an addition in the way of a percentage on direct labor or an equivalent method, in common with other items of "burden." Here we have an example of labor expended in handling miscellaneous materials which would be accounted as "nonproductive" labor.

If, however, we consider the employment of labor in transportation, in the handling of miscellaneous materials, it would naturally be accounted as "direct" labor, since it accomplishes an important and definite step in the process of transportation, and should therefore be subject to its pro rata share of all fixed charges whether it is labor used or labor saved by an improved process or by the substitution of mechanical process.

In the opinion of the committee, current practice which usually takes no account of "fixed charges" or "burden" on the excess of labor used by one process or on the labor saved by another process represents a grave error in any analysis of comparative costs. Also in some cases where "burden" is added to "direct labor" in calculating comparative costs, it is omitted entirely where the labor is accounted as "nonproductive," or indirect.

Based upon these considerations, the following rule for setting a value upon labor saved by an improved process has been evolved:

Whatever valuation is arrived at in cost accounting as the cost per unit of *labor used* in production also establishes the value per unit of labor *saved* by an improved process. For simplicity, no monetary value need be placed upon labor employed in comparative processes, except upon the amount of *difference* in labor required at the current rate aid, plus "burden" or an equivalent.

Other items of cost should in like manner be accounted at the same rate as for similar items in making up the cost of product.

In calculating comparative cost a new item is introduced which never becomes a factor in regular cost accounting, namely, the monetary value of increased production. The profitableness of any industry stands or falls upon the relation between total cost of production and total volume and hence value, of product.

An increase of product with a given equipment will affect the spread between cost and the market value of product just as vitally as an equivalent reduction in some or all of the items of cost. Accordingly, no system of comparative cost accounting can pretend to even approximate accuracy which does not place a suitable valuation upon increased productivity.

In placing a valuation upon increased productivity it should be borne in mind that in any industry the volume of product required to just meet the costs of the plant and a given organization affords *no profit;* also that any product above that amount is obtained without any manufacturing cost whatever; hence the rule:

In a comparative accounting increased production will always carry a higher value than that attached to normal production.

The committee therefore unanimously recommends the following methods:

Let:

Debit Items:

- A = percentage allowance on investment
- B = percentage allowance to provide for insurance, taxes, etc.
- C = percentage allowance to provide for upkeep
- D = percentage allowance to provide for depreciation and obsolescence
- E = yearly cost of power, supplies and other items which are consumed, total in dollars

Credit Items:

- S = yearly saving in direct cost of labor in dollars
- T = yearly saving in fixed charges, operating charges or burden, in dollars
- U = yearly saving or earning through increased production, in dollars

- X = percentage of year during which equipment will be employed
- I = initial cost of mechanical equipment

Results:

- Z = maximum investment in dollars justified by the above consideration,
- Y = yearly cost to maintain mechanical equipment ready for operation
- V = yearly profit from operation of mechanical equipment

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*A report to the American Society of Mechanical Engineers, reprinted from their proceedings.

Then

$$Z = \frac{(S+T+U-E)X}{A+B+C+D} \quad \text{.................}[1]$$

$$Y = I(A+B+C+D) \quad \text{....................}[2]$$

and

$$V = [(S+T+U-E)X] - Y \text{ ....}[3]$$

Feeling that handling machinery, even if left idle a large part of the year, would probably require, under most conditions, approximately the same repair through deterioration as though in use, the committee makes no deduction for such lack of use in the estimated cost of upkeep C. If greater accuracy be considered necessary, use C multiplied by X in place of C in the formulas.

Applications of the Formulas

As an example of an application of the formulas, assume that the handling of miscellaneous materials about a factory which has formerly been done by four men receiving \$3.50 per day each, or, allowing 300 days per year, at an annual direct cost of \$4200, can be done by one man operating an electric storage-battery industrial truck at a direct-labor cost of \$1050 per year, thus effecting a saving at the rate of \$3150 per year in direct-labor cost.

Assume also that through the greater promptness in moving materials and the more continuous operation of machines there is an increase in earnings, due to increased production, valued at \$650 per year; also that the labor involved, being accounted as "nonproductive," carries a fixed charge or burden of 10 per cent. In actual practice the plant operates 240 days per year, or 80 per cent of the time. The various factors therefore are estimated as follows:

$A =$ 6 per cent $\quad S =$ \$3150
$B =$ 4 per cent $\quad T =$ 315
$C =$ 20 per cent $\quad U =$ 650
$D =$ 25 per cent $\quad X =$ 80 per cent
$E =$ \$450

$$Z = \frac{(\$3150+\$315+\$650-\$450)\times 80}{55} = \$5331$$

This indicates that equipment costing any sum below \$5331 will earn some profit above interest on investment and maintenance.

Assume that an electric storage-battery industrial truck will meet the conditions stated and that its cost will be \$2200. Then the yearly cost to maintain equipment ready for operation, exclusive of labor, will be expressed by the formula, $Y = (A+B+C+D)$ or \$2200 × 55 per cent = \$1210. Then the profit from operation of the mechanical equipment, according to [3], becomes (\$3150 + \$315 + \$650 − \$450) × 0.80 − \$1210 = \$1722.

The profit V, or \$1722, represents an annual earning upon the initial investment, over all items of cost, of over 78 per cent.

If, however, our example be applied to handling cargo at a railroad or marine terminal where the labor is ***productive labor*** and subject to ***all*** fixed charges as burden, an important difference in result will be had, indicating the importance of the factors T and U, and the necessity of placing proper values upon them if reliable results are to be had.

As such an example of an application of the formulas, assume that in handling miscellaneous cargo at a marine terminal, work which has formerly been done by four men receiving \$3.50 per day each, or, allowing 300 days per year, at an annual direct cost of \$4200, can be done by one man operating an electric storage-battery industrial truck at a direct-labor cost of \$1050 per year, thus effecting a saving of \$3150 per year in direct-labor cost.

Since this labor is productive labor, it will bear its pro rata share of all fixed charges, estimated at 50 per cent and to be added to the direct-labor cost, representing a further saving of \$1575 on account of labor. Also that, though the greater promptness in unloading and loading vessels, 5 per cent more ships can be accommodated, accounting for 15 days' extra use of the pier yearly. Assuming the investment in the pier to be \$1,000,000 and interest, taxes, etc., at 10 per cent, we have a credit item of 0.5 per cent to be divided, say, between 20 electric trucks, or \$250 per truck per annum.

Applying the formulas as in the previous example, we have

$$Z = \frac{(\$3150 + \$1575 + \$250 - \$450) \times 80}{55}$$

= \$6582 permissible investment.

The yearly cost of operation is $Y =$ \$2200 × 0.55 = \$1210 as in the previous example. The profit above maintenance charges, V, will then be (\$3150 + \$1575 + \$250 − \$450) × 0.80 − \$1210 = \$2410.

The profit \$2410 represents an annual earning of nearly 110 per cent upon the investment in this case in place of 78 per cent in the previous example, all factors having been upon exactly the same basis except T (yearly saving in fixed charges) and U (yearly saving through increased production).

The following summary shows the relative value of the same device applied to two conditions, first, where the labor employed in the work is unproductive as regards producing an article of manufacture, and, second, where the labor used produces the salable commodity, in this case material handling.

	Case 1, Handling in Factory	Case 2, Handling in Marine Terminal
Cost of equipment	\$2200	\$2200
Z, investment justified	5331	6582
Y, yearly maintenance	1210	1210
V, profit from installation	1722	2410
Per cent return on investment	78	110

A study of this comparison indicates that with suitable values given to the factors the formulas proposed show not only the advantages obtainable under various conditions, but also that a device may be much more valuable per dollar invested in one industry than in another. The difference shown would have been much more pronounced had regular stevedore wages been used for the wages of the man at the marine terminal.

The personnel of the committee which prepared this report consisted of W. F. Hunt, consulting engineer, New York; J. A. Shepard, of the Shepard Electric Crane and Hoist Co., Montour Falls, N. Y., and C. H. Newman, New York.

Reactions on the Fuel Bed of a Gas Producer

BY means of an experimental gas producer burning anthracite coal at industrial rates, a study has been made of the effect of two primary variables, depth of fuel bed, and rate of firing on the reactions taking place in the fuel bed. The work was carried on by R. T. Haslam, R. F. Mackie and F. H. Reed of the Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Mass., and their experimental data and findings published in the January, 1927, number of *Industrial and Chemical Engineering.*

The conclusions derived are:

1. Cold gas efficiency is increased by increasing the rate of firing at constant depth and constant blast saturation. (Pounds of steam per pound of coal.)
2. Cold gas efficiency is increased by increasing depth of fuel bed at constant rate of firing and constant blast saturation. (Pounds of steam per pound of coal.)
3. Percentage steam decomposition and higher heating value of gas (B. t. u. per cubic foot, gross, 30 in. mercury, 60 deg. F., H_2O saturated) also increase with increasing depth of fuel bed and rate of firing at constant blast saturation.
4. The increased steam decomposition is due to increased temperature in the primary reduction zone. The effect of time of contact of water vapor with carbon is secondary to the temperature effect.
5. The thickness of the primary reduction zone is independent of the depth of fuel bed and rate of firing.
6. The thickness of the oxidation zone is independent of the depth of fuel bed and rate of firing.
7. The main effect of increasing rate of firing and depth of fuel bed is to increase the temperature of the primary reduction zone.
8. Steam admitted with blast passes through the oxidation zone—i.e., to the point where oxygen in the gas has practically disappeared—without appreciable decomposition.
9. The percentage of combustible matter (hydrogen and carbon monoxide) in the final gas increases with increasing depth of fuel bed and increasing rate of firing.

Bonnot Takes Over Cummer Dryer

THE Bonnot Co., Canton, Ohio, has taken over the manufacture and sale of the Cummer dryer, which will hereafter be known as the Bonnot-Cummer dryer. This dryer has been used for drying rock products for a number of years and was one of the first introduced for calcining gypsum, plasters and stucco in the United States.

Best Bros. Keene's Cement Company Reorganized

A REORGANIZATION of the Best Bros. Keene's Cement Co., Medicine Lodge, Kas., has been completed, according to information published in the Medicine Lodge, Kas., *Index*. Some of the old stockholders are retiring and their stock is being absorbed largely by the present stockholders. Thos. J. Best, former president of the company, is retiring as president and majority stockholder, it is said. The redistribution of the stock caused by the reorganization of the company means that the company will remain in virtually the same hands as heretofore. John C. Best becomes a heavily interested member of the company. That part of the stock which will not be taken over by other stockholders will be retired through an anticipated bond issue, it is said. The company has increased its capital stock to $1,000,000 and has been re-chartered for that amount.

During the forthcoming year an extensive program of expansion has been outlined. Four new concrete silos 90 ft. in height, to be used for storage of Keene's cement, will be built. Other construction includes a new mill building near the present operations. The company is also reported to have purchased additional quarry property near Sun City, Kas.

Staso Milling Company to Build Georgia Crushing Plant

ACCORDING to a report in the Jasper, Ga., *Progress*, the Staso Milling Co., Chicago, Ill., have begun the construction of a large crushing plant at Whitestone, Ga., at a cost of about $175,000 including equipment. When completed, the estimated capacity will be about 300 tons per day. Plans include a spur track connection with the railroad.

The new plant is located on a deposit worked some years ago by the Crystal Marble Co. The material to be crushed is a limestone formation commonly called whitestone.

Bradley Co. to Build Second Electric Self-Unloader

FOLLOWING the success of the S.S. "T. W. Robinson," the Bradley Transportation Co., of Rogers City, Mich., has decided to put in service another boat of the same type. The "T. W. Robinson," the only boat of its kind in the world, went into service in July, 1925, and has been operating successfully since that time. It embodies the first application of turbine-electric drive to a bulk freighter.

On the "T. W. Robinson," with a relatively high pressure, high superheat, watertube boiler installation using stoker firing, there was also installed turbine-electric drive with a motor direct connected to the propeller shaft. All maneuvering is done from a simple control stand located alongside the main turbine generator. Electrification has been carried out almost entirely for the engine room auxiliaries, deck auxiliaries and galley equipment.

The second boat will be much larger. It will be built by the American Shipbuilding Co. and will be used in the same service—transporting limestone from the plant of the Michigan Limestone and Chemical Co. to various ports on the Great Lakes. Turbine-electric drive will be used, similar to that on the "T. W. Robinson," but of greater horsepower. There will also be a more complete electrification of the auxiliaries. The General Electric Co., who supplied the generating, propulsion and the majority of the auxiliary electrical equipment on the "T. W. Robinson," will also furnish the power plant, propulsion motor and electrical auxiliary equipment for the new boat.

Florida Silica Sand Company Plans Expansion Program

THE erection of two additional plants is contemplated within the near future by the Lake Weir Silica Products Corp., Ocala, Fla., according to advice received from Louis P. Magid, president. The Lake Weir company just completed the installation of an electric-drive sand dredging plant, as announced on page 110 of the January 22 issue of ROCK PRODUCTS.

The first plant, President Magid states, will consist of a 10-in. dredge pump with other necessary equipment, and will have a capacity of turning out 40 cars of washed silica sand daily. A silica pulverizing plant with a capacity of 30 tons daily, that will produce pulverized silica sand in 140 to 400 mesh, is also under consideration.

Sales of Lime in 1926

THE lime sold by producers in the United States in 1926 amounted to 4,580,000 short tons, valued at $40,800,000, according to estimates furnished by lime manufacturers to the Bureau of Mines, Department of Commerce. This is approximately the same quantity, but a decrease of 4% in value as compared with sales in 1925. The sales of hydrated lime, which are included in these figures, amounted to 1,570,000 tons, valued at $14,576,000, a small increase in quantity and a decrease of 5% in value. The average unit value of all lime showed a decrease from $9.30 a ton in 1925 to $8.91 in 1926, and that of hydrated lime a decrease from $9.79 a ton in 1925 to $9.28 in 1926.

Ohio, the leading state, showed a decrease of 2% in total sales and 5% in sales of hydrated lime. Pennsylvania, which ranked second, showed an increase of 4% in total sales. Of the 22 states in which more than 25,000 tons were sold, 12 showed increased sales, but in no state was the increase or decrease large.

Sales of lime for construction and for chemical uses in 1926 were both about the same or possibly slightly less than in 1925 and are estimated at 2,372,000 tons for building lime and 1,893,000 tons for chemical lime. The demand for lime for use in agriculture appeared somewhat better in 1926 than in 1925, despite weather conditions—especially in the Central States, which are reported to have restricted sales. The estimated sales for this use are 315,000 tons, an increase of 5%.

The figures given below are preliminary and subject to later revision:

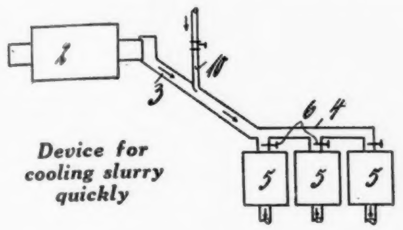
LIME SOLD BY PRODUCERS IN THE UNITED STATES IN 1925 AND 1926

	1925			1926 (estimated)		
	Hydrated Lime	Total Lime		Hydrated Lime	Total Lime	
State	(Short tons)		Value	(Short tons)		Value
Ohio	779,286	1,089,385	$10,970,605	743,000	1,069,000	$10,455,000
Pennsylvania	219,737	794,951	6,425,675	225,000	828,000	6,615,000
West Virginia	51,608	270,895	1,879,223	42,000	268,000	1,622,000
Missouri	71,290	273,348	2,610,954	82,000	253,000	2,188,000
Wisconsin	18,650	244,903	2,204,504	17,000	215,000	1,886,000
Alabama	25,989	207,699	1,679,155	30,000	202,000	1,613,000
Massachusetts	(*)	197,732	2,610,279	(*)	187,000	2,263,000
Virginia	52,374	192,429	1,491,568	56,000	187,000	1,381,000
Tennessee	48,364	175,685	1,344,508	52,000	183,000	1,352,000
Maine	(*)	115,571	1,291,812	(*)	134,000	1,452,000
Indiana	43,815	127,878	1,067,040	47,000	121,000	922,000
Michigan	(*)	95,036	909,952	(*)	111,000	1,053,000
New York	32,129	104,829	1,030,960	37,000	108,000	1,032,000
Illinois	(*)	96,066	928,000	(*)	101,000	999,000
Texas	29,529	74,638	698,138	34,000	81,000	726,000
California	8,175	70,805	745,132	7,000	76,000	811,000
Maryland	33,768	64,518	524,100	33,000	65,000	497,000
Connecticut	(*)	58,449	672,821	(*)	56,000	540,000
Vermont	(*)	66,245	788,936	(*)	55,000	590,000
Arizona	(*)	39,045	394,023	(*)	53,000	518,000
Arkansas	(*)	24,791	223,965	(*)	32,000	276,000
Minnesota	(*)	(*)	(*)	(*)	(*)	(*)
Nevada	(*)	(*)	(*)	(*)	(*)	(*)
Washington	(*)	29,636	357,297	(*)	25,000	328,000
Undistributed	145,594	166,289	1,759,862	165,000	170,000	1,681,000
	1,560,848	4,580,823	$42,609,141	1,570,000	4,580,000	$40,800,000

(*) Included under "Undistributed."

Foreign Abstracts and Patent Review

Treatment of Cement Slurry. The illustration shows the arrangement of the apparatus in diagrammatic form that is employed in the treatment of cement mill slurry. The grinder is shown at *2*. The slurry in a warm state is carried by means of a transporting device or conduit *3*, which



Device for cooling slurry quickly

has a cold water inlet *10* with which the warm slurry comes in contact. Through this means the slurry is quickly cooled down to the room temperature and is then fed through a distributing pipe *4* and the valves *6* into the tanks and containers *5*, from which it can be withdrawn as needed. Quick cooling of the slurry is essential because it might otherwise absorb a considerable quantity of water which would cause the ingredients to set or harden. *German Patent Application No.* 45,895.

Hardening of Super Cements. Temperature has an important bearing on the hardening of super cements. A difference of only a few degrees of temperature in the water in which the cement sample is being kept for examination purposes or in the humidity of the air in which the cement samples are stored greatly effects the mechanical strength of the cement. In strength tests which were made after a three-day period of storage it was found that the difference amounted to as much as 60 kg./cm.^{2} in compression tests. Hence it follows that both the temperature and humidity must be taken into consideration when testing these cements as well as in using them for construction purposes.

It has also been observed that certain of the super cements do not resist the dessication treatment in a satisfactory manner. The samples are apt to crack along the edges. Such cements are said to be not really super cements but merely ordinary portland cements which have been ground extremely fine or high-lime cements. Cracking is probably due to the internal strain set up when water is evaporated from them at raised temperatures. Super cements should not be ground too fine and should leave a residue of about 8% on a 5000-mesh screen. *Tonindustrie* (1926), **50,** 668-9.

Efflorescence and Capillary Fissures in Cement Mortars. Efflorsescence is caused either by underburned cement which contains particles of uncalcined calcium carbonate or by the hydration and subsequent carbonation of the excess lime set free during setting of over-limed cements. In the first case, the calcium carbonate being lighter comes to the surface and in the presence of moisture and air containing CO_2 is converted to the soluble bicarbonate. The bicarbonate easily reverts to the insoluble calcium carbonate and this precipitates on the cement surface, giving it a streaky white coloration.

During the setting of high-lime cements the excess lime hydrate is set free and converted through the action of CO_2 and water into the soluble calcium bicarbonate. This bicarbonate comes to the surface and is changed to the insoluble carbonate. The resulting white appearance of the cement surface is called efflorescence.

Capillary cracks are only superficial and do not indicate an unsound concrete. They may be avoided by using mortars that are not too rich and exercising precaution in the selection of mixing water. The concrete should be covered and kept in a humid condition, the surface being sprinkled to retard the setting of the upper cement layer. *Ind. Cemento,* **23,** 67-68.

Rapid Determination of Silica and Lime in Raw Cement Mixture. Silica is determined in the raw mixture used for making blast furnace cement by digesting a small sample with concentrated hydrochloric acid, evaporating to dryness and treating the residue with dilute acid, then filtering and weighing. The filtrate is made alkaline with ammonia and then acid with acetic acid. Iron and aluminum are precipitated as phosphates and without filtering calcium is precipitated as oxalate. The combined precipitates are purified by redissolving and precipitating, and are finally dissolved in sulphuric acid and lime determined by titrating the oxalic acid with potassium permanganate. *Zeit. fuer angewandte Chemie,* 39, 278.

Changes in Physical State of Cement During Setting. The changes in the specific gravity and in the quantity of water uniting with cement during setting show that the quality of a cement depends on its ability to combine with a large proportion of water in minimum time, this determining the compactness and the strength of the product. The rapidity of hardening increases with the fineness of the cement, and the quality of the latter depends largely on the system of burning employed. Since the difference between the specific gravity of the aggregate and that obtained after it has hardened in water for a given time determines its strength, it is possible to obtain a rapid measure of the intrinsic value by two measurements of the specific gravity at a short interval. *Giornale Chimica Industria Applicata,* 1926, v. 8, 469-472.

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Superintendent of Documents, Government Printing Office, Washington, for each patent desired.

Silica Brick. A mixture of diatomaceous earth and comminuted sulphur is molded and dried. On firing the sulfur is converted to the gaseous phase and the silica particles are fluxed and fritted with the alkaline earths present forming a compact mass. *T. C. Pond, U. S. Patent No.* 1,612,649.

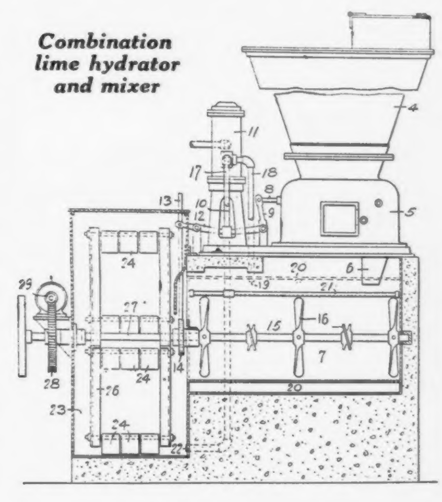
Plaster Reviver. A plaster-reviving composition consisting of bentonite calcined sufficiently only to substantially destroy the colloidal properties of the raw material.—*C. W. Young, U. S. Patent No.* 1,613,689.

Cellular Plaster Blocks. Method of forming insulating blocks which consists in casting a plastic mass that will expand and set, allowing the mass to rise, and then dressing down the top surface of the block by a series of scraping and smoothing operations serving to break down the expanded formation at the surface and serving thereby to provide a relatively dense and tough skin.—*H. S. Ashenhurst, U. S. Patent No.* 1,613,639.

Purifying, Enriching and Refining Crude Graphite. The crude graphite is crushed and ground wet and sifted while subjected to a spray of water to separate the graphite. The sifted graphite is chemically treated to remove the residual gangue.—*E. J. E. Dumond, U. S. Patent No.* 1,614,352.

Lime Hydrator and Mixer. Lime-treating apparatus comprising a hydrating chamber and a solution chamber with mixing

Combination lime hydrator and mixer



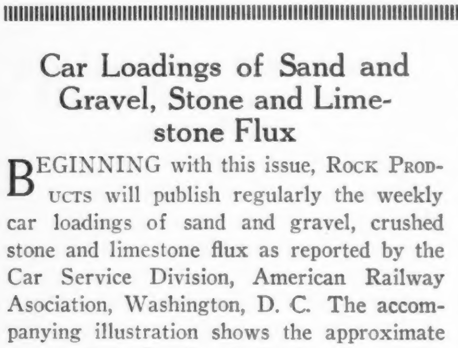
devices in each and a means for controlling the relative amounts of lime and water supplied to the hydrating chamber and to also control the relative amounts of hydrated lime and water supplied the mixing chamber.—*F. R. Leopold, U. S. Patent No.* 1,613,663.

Traffic and Transportation

EDWIN BROOKER, Consulting Transportation and Traffic Expert
Munsey Building, Washington, D. C.

Car Loadings of Sand and Gravel, Stone and Limestone Flux

BEGINNING with this issue, ROCK PRODUCTS will publish regularly the weekly car loadings of sand and gravel, crushed stone and limestone flux as reported by the Car Service Division, American Railway Association, Washington, D. C. The accompanying illustration shows the approximate extent of the 7 railroad districts into which the country has been divided.



CAR LOADINGS OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

District	Limestone Flux Week ended Jan. 1	Jan. 8	Sand, Stone and Gravel Week ended Jan. 1	Jan. 8
Eastern	1,911	2,178	1,533	1,549
Allegheny	2,780	3,173	1,697	2,434
Pocahontas	79	146	148	358
Southern	365	503	6,669	10,407
Northwestern	805	796	1,287	1,506
Central Western	330	419	4,180	5,156
Southwestern	219	372	2,378	4,318
Total	6,489	7,587	17,892	25,728

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning January 31:

SOUTHERN FREIGHT ASSOCIATION DOCKET

31372. **Sand,** from Coosada and Oktamulke, Ala., to Pensacola, Fla. Present rate, 162c; proposed rate on sand, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from and to points named, 144c per net ton, same as applicable from Prattville Junction, Jackson's Lake and Montgomery, Ala., to Pensacola, Fla.

31437. **Sand,** from Ottawa, Ill., to Chattanooga, Tenn. It is proposed to establish as a specific through rate for application via all gateways, Jackson, Tenn., combination of 498c per net ton on sand, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to full visible capacity actual weight will govern, from Ottawa, Ill., to Chattanooga, Tenn.

31440. **Sand and gravel,** from Lilesville-Pee Dee district to points in North Carolina. It is proposed to publish basis to apply on North Carolina intrastate traffic and to provide that Lilesville or Pee Dee, N. C., rates (whichever are lower) will apply on sand and gravel, carloads, from Lilesville, Cement Siding, 128-Mile Siding, Ballast Point (Bonsal Siding), Hedrick and Wade Siding and Pee Dee, N. C., to points in the state of North Carolina.

21441. **Sand and gravel,** from Montgomery, Ala., to Aucilla, Chaires and Perkins, Fla. It is proposed to establish reduced rate of 189c per net ton on sand and gravel, in straight or mixed carloads, minimum weight 90% of the marked capacity of car, except when cars are loaded to their visible capacity actual weight will apply, from Montgomery, Ala., to Aucilla, Chaires and Perkins, Fla., same as the present rate from Montgomery to Madison, Ellaville, West Farm, Lee, Dickert, Falmouth and Hinley's Spur, Fla.; also same as current rate to Jacksonville and to Greenville, Fla.

31461. **Crushed stone,** from Whitestone, Ga., and crushed marble from Tate, Ga., to Hillside, Ill. In lieu of Cincinnati combination of 695c per net ton, it is proposed to establish the following through rates on the commodities mentioned below to Hillside, Ill.: From Whitestone, Ga., on stone, crushed, carloads, minimum weight 90% of marked capacity of car, except that when cars are loaded to their visible capacity actual weight will govern; from Tate, Ga., on marble, crushed, carloads, same minimum as above, 447c per net ton, made in line with rates on this commodity, from other southeastern points.

31361. **Granite and stone,** crushed or rubble, etc., from Greystone, N. C., to R. F. & P. R. R. stations. In lieu of Class "A" rates it is proposed to establish through commodity rates on granite and stone, crushed or rubble, and screenings, granite and stone, carloads, minimum weight marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from Greystone, N. C., to stations on the R. F. & P. R. R., Ruther Glen, Va., to Washington, D. C., inclusive, based combination on Richmond, Va., without the use of Agent Jones' Combination Tariff. The proposed rates range from 178c to Ruther Glen, Va., up to 203c to Woodford, Va., and 242c per net ton to Washington, D. C.

31339. **Limestone** from Ladds, Ga., to Lyman, S. C. Present rate, 230c per net ton. (Combination.) Proposed rate on limestone, ground or pulverized, carloads, minimum weight marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from Ladds, Ga., to Lyman, S. C., 194c per net ton, made on basis of the proposed Georgia Joint Line Scale, less 10%, for distance of 239 miles.

10793. **Lime,** from points in Arkansas to points on the Missouri Pacific. To establish a rate of 13c per 100 lb. on lime, carloads, minimum weight 50,000 lb., from Limedale Spur and Ruddells, Ark., to Missouri points shown below: St. Louis, Jefferson Barracks, Quarry Spur, Koch, Bousan, White House, Kimswick, Sulphur Springs, Glen Park, Riverside, Pevely, Horine, Silica, Hematite, Victoria, De Soto, Vineland, Blackwell, Tiff, Angus, Cadet, Mineral Point, Summit, Hopewell, Irondale, Bismarck, Iron Mountain, Middlebrook, Lopez, Pilot Knob, Ironton, Arcadia, Hogan, Glover, Chloride, Sabula, Annapolis, Leadanna, Vulcan, Booser Spur, Des Arc, Gad's Hill, Platow, Piedmont, Carters, Clearwater, Leeper, Mill Spring, Granite Bend, Williamsville, Blum, Keeners, Hendrickton, Wilby, Hilliard, Mengo, Poplar Bluff, Walsh, Harviell, Neelyville.

It is stated that the Arkansas producers are not in position to place any lime at St. Louis in competition with Johnsons, Ark., and, therefore, request that same rate be applied from Limedale Spur and Ruddells, Ark., at minimum weight of 50,000 lb.

31527. **Sand** from Mack, Ga., to Riceboro, Warsaw and Townsend, Ga. It is proposed to establish reduced rate of 100c per net ton on sand (common), straight or sand and gravel, mixed, in bulk, carloads, minimum weight 60,000 lb., from Mack, Ga., to the destinations named above, made by use of Trunk Joint Line scale (Table 2) of Agent Glenn's I. C. C. A-529.

31546. **Stone, broken or crushed,** from Lacon, Ala., to Cullman, Hanceville, Garden City and Decatur, Ala. It is proposed to establish the following reduced rates on stone, broken or crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Lacon, Ala., to Cullman, Ala., 54; Hanceville, Garden City and Decatur, Ala., 63c per net ton, and apply only on intrastate traffic. The proposed rates are made in line, distance considered, with rates suggested on slag, from Ensley, Ala., under Submittal No. 31307.

31556. **Limestone** from Ladds, Ga., to Western Ry. of Alabama stations. Rate of 197c per net ton now applies to Montgomery, Ala., and combination rates to other Western Ry. of Alabama stations. It is proposed to establish through rates on limestone, ground or pulverized, carloads, minimum weight marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Ladds, Ga., to all stations on the Western Ry. of Alabama, on basis of the proposed Georgia joint line scale, reduced 10%, for distance via S. A. L. Ry., Atlanta, A. & W. P. R. R., West Point, Ga., and Western Ry. of Alabama.

31562. **Stone, marble or slate, crushed or broken,** from Fairmont and Bolivar, Ga., to New Orleans, La. In lieu of present rate of 293c per net ton it is proposed to establish rate of 280c per net ton on stone, marble or slate, broken or crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Fairmount and Bolivar, Ga., to New Orleans, La. The proposed rate is the same as rate applicable on crushed stone, carloads, from and to the same points.

31598. **Stone, broken and crushed,** from Calera, Ala., to New Orleans and Baton Rouge, La., and from Elvira, Keystone and Wilmay, Ala., to New Orleans, La. It is proposed to establish the following reduced rates on stone, broken and crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern: From Calera, Ala.: To New Orleans, La., 169c; to Baton Rouge, 180c per net ton; same as in effect from Dolcito, Ala. From Elvira, Ala., to New Orleans, La., 169c, and from Keystone and Wilmay, Ala., to New Orleans, 169c per net ton; same as proposed from Calera, Ala.

31687. **Stone,** ground or pulverized, between points on the C. N. O. & T. P. Ry. It is proposed to revise the mileage rates applicable on ground or pulverized stone, carloads, between points on the C. N. O. & T. P. Ry., as published in that line's tariff, I. C. C. 4560, to be no lower than the mileage scale applicable on crushed stone, carloads, as published in So. Ry. I. C. C. A-10029.

31699. **Sand and gravel,** from Montgomery, Ala., to S. A. L. Ry. Florida points. It is proposed to establish rate of 189c per net ton on sand and gravel, carloads, usual description, from Montgomery, Ala., to S. A. L. Ry. stations between Tallahassee and Chattahoochee River, Fla., not including River Junction, Fla. The proposed rate is the same as the present rate from Montgomery to Madison, Ellaville, West Farm, Lee, Dickert and other points on the S. A. L. Ry. Jacksonville-River Junction line.

31755. **Gravel,** from Gadsden, Ala., to Atlanta, Ga., Birmingham, Ala., Rome, Ga., Cedartown, Ga., and Anniston, Ala. It is proposed to establish the following reduced rates on gravel, carload, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Gadsden, Ala.: To Atlanta, Ga., and Cedartown, Ga., 120c; Birmingham, Ala., 80c (intrastate only); Rome, Ga., 80c; Anniston, Ala., 80c per net ton (intrastate only). The proposed rates, except to Anniston, Ala., are the same as the current rates on sand, carloads. To Anniston, Ala., same as proposed to Birmingham, Ala.

ILLINOIS FREIGHT ASSOCIATION DOCKET

646C. **Sand,** molding, carloads, from Ritchie, Ill., to Canton, Ill. Present rate, 150c per net ton; proposed, 130c net ton.

3944. **Sand and gravel,** carloads, minimum weight marked capacity of car. Present rate—From Coleman, Ill., to Genoa, Ill., 68c per net ton; from Rockford, Ill., to Genoa, Ill., 68c per net ton. Proposed—From Coleman, Ill., to Genoa, Ill., 60c per net ton; from Rockford, Ill., to Genoa, Ill., 60c per net ton.

3970. **Lime,** carloads, minimum weight 30,000 lb., from Chicago, Ill.

To—	Pres.	Prop.
Farmer City, Ill.	17	11
Havana, Ill.	20	12.5
Le Roy, Ill.	17	11

3973. **Sand and gravel,** carloads, minimum weight 90% of marked capacity of car, except when car is loaded to full visible capacity actual weight will apply, per ton of 2000 lb., from Cairo, Ill., to Pittsburgh and Paulton, Ill. Present rate, 200c per net ton; proposed, 101c per net ton.

1743-G. Sand, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to full visible capacity, actual weight will govern, from Ottawa, Ill., to Chattanooga, Tenn. Present,* 498c per net ton; proposed, 498c per net ton.

*Combination, based 340c per net ton to Ottawa, Ill., to Jackson, Tenn., and 158c per net ton to Jackson, Tenn., to Chattanooga, Tenn.

SOUTHWESTERN FREIGHT BUREAU DOCKET

10904. Gravel, from points in Kansas to Amarillo, Texas. To estabish rate of 10½c per 100 lb. on gravel, carloads, minimum weight marked capacity of car, except when loaded to full visible capacity, actual weight, but not less than 50,000 lb., will govern, from Wichita and Arkalon, Kan., to Amarillo, Texas. It is desired to establish same rates on gravel, carloads, as is applicable on sand.

10922. **Sand and gravel**, from Muscatine, Iowa, to points southwest. To establish to destinations in Texas and Oklahoma rates as outlined below. To points in Arkansas and Louisiana establish rates based on 38c per ton of 2000 lb. less than those applicable in S. W. L. Tariff 114-B, from Ottawa, Ill., on sand and gravel, straight or mixed carloads, minimum weight 80,000 lb. or marked capacity of car if that be less than 80,000 lb., from Muscatine, Iowa:

To—	Rates	To—	Rates
El Paso Group	$10.36	Bartlesville	4.12
Galveston-Houston	7.86	Bristow	4.12
		Collinsville	4.12
Texas common points	7.86	Henryetta	4.12
		Muskogee	4.12
Okarche	4.72	Okmulgee	4.12
Southard	4.72	Sand Springs	4.12
Ft. Sill	4.82	Shopton	4.12
Lawton	4.82	Tulsa	4.12
Ada	4.62	Blackwell	4.12
Oklahoma City	4.62	Sapulpa	4.12
Wetumka	4.62	Checotah	4.12

Shippers at Muscatine, Iowa, request the publication of rates that will enable them to compete with Ottawa, Ill.

10961. **Ground limestone**, from Carthage, Mo., to East St. Louis, Ill., and St. Louis, Mo. To establish proportional rate of 10c per 100 lb. on ground limestone, carloads, minimum weight marked capacity of car, except when car is loaded to full visible capacity, actual weight will apply, from Carthage, Mo., to East St. Louis, Ill., and St. Louis, Mo., applicable on traffic destined points east of the Illinois-Indiana state line. Proposed rate, it is stated, is necessary to enable shippers of ground limestone at Carthage, Mo., to compete with shippers of this material at Sparta, Tenn.

10977. **Lime**, from Mercer, Ark., to St. Joseph, Mo. To establish rate of 14c per 100 lb. on lime, carloads, minimum weight 30,000 lb., from Mercer, Ark., to St. Joseph, Mo. It is desired to establish rate of 14c per 100 lb. with a minimum weight of 30,000 lb. in lieu of the present rate of 24,000 lb. The proposed rate is the same as that now in effect from Ruddells, Ark.

CENTRAL FREIGHT ASSOCIATION DOCKET

14858. **Crushed or ground gravel**, carloads, E. St. Louis, Ill., on traffic originating in Missouri to North Tonawanda, N. Y. Present rate, 520c per ton of 2000 lb.; proposed, 410c per net ton.

14866. **Crushed stone, carloads**, Thrifton, Ohio, to points in Ohio, following rates:

To— (N. & W. Ry.)	Proposed rate, per net ton. Crushed stone.	Proposed rate, per net ton. Rip-rap stone.	Present rate, per 100 lb. Crushed rip-rap and stone.
Circleville	80	100	12
Corwine	80	100	11½
Elmwood Farm	80	100	12
Fosters	80	100	11½
Hayesville	80	100	12
Higbys	80	100	11½
Kingston	80	100	12
Kinnickinnick	80	100	12
Lunbeck	80	100	11½
Omega	80	100	11½
Pride	80	100	11½
Waverly	80	100	11½

Present rates, 6th class, per Agent Jones' I. C. C. 941.

14863. **Gravel and sand**, other than blast, core, engine, fire or filter, glass, grinding or polishing, molding and silica, carloads, Ambridge, Baden, Freedom and Rochester, Penn., to Revere Works, Penn. Present rates, 6th class; proposed, 135c per net ton.

14905. **Crushed stone**, carloads, Narlo, Ohio, to Ft. Wayne, Ind. Present rate, 104c per net ton; proposed, 81c per net ton.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

11517. **Gravel screenings**, carloads, minimum weight 90% marked capacity of car, from Greenbush, Mass., to Boston, Mass., 60c per ton of 2000 lb. Reason—To establish same basis of rates between these points on screenings as on sand, the screenings being a by-product of the sand.

11524. **Sand**, common or building, carloads, minimum weight 90% of marked capacity of car, except when the combined weight of the car and lading exceeds the published maximum weight limits, in which case the minimum weight will be the maximum weight from Greenbush, Mass., to N. Y. N. H. & H. and C. N. E. Ry. stations. Reason—To provide commodity rate for new sandpit.

11545. **Sand-lime brick**, carloads, minimum weight 60,000 lb., from Winchester to Boston, Mass., 5½c. Reason—To meet motor truck competition.

11639. **Molding sand**, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity, actual weight will apply, from Elnora, Mechanicville, Reynolds, Schaghticoke, Schuylerville, Scotia, Saratoga Springs, Stillwater, Wayville and Ushers, N. Y., to Rutland, Vt., 6, via White Creek, N. Y., and Rutland R. R. Reason—To place the sand pits located on the B. & M. R. R. on a comparable basis with those located on the D. & H. Co.

11660 (1-A). **Sand**, blasting, core, fire and sea, carloads, minimum weight 90% of marked capacity of car, from Provincetown, Mass., to Boston, Mass., 9½c. Reason—To place rate on same basis as other existing commodity rates.

11666 (2-R). **Lime**, hydrated, carloads, minimum weight 40,000 lb., from Swanton, Vt., to Waterville, Maine, 18, via St. J. & L. C. R. R., St. Johnsbury, Vt., and Me. C. R. R. Reason—Equalization of rates to contiguous points.

TRUNK LINE ASSOCIATION DOCKET

14596. (A) **Building lime**, carloads, minimum weight 30,000 lb.; (B) agricultural, land, chemical, gas, glass, lime, carloads, minimum weight 30,000 lb.; also ground limestone, carloads, minimum weight 50,000 lb., from Bellefonte and Pleasant Gap, Penn., to Devault, Penn., (A) 11½c, (B) 11c per 100 lb. Reason—Rates are comparable with present rates from Bellefonte, Penn., to points in contiguous territory.

14609. (A) **Building lime**, carloads, minimum weight 30,000 lb.; (B) agricultural, land, chemical, gas, glass, lime, carloads, minimum weight 30,000 lb., and also ground limestone, carloads, minimum weight 50,000 lb., from Knickerbocker, Howellville, Henderson, Swedeland, Rambo, Plymouth Meeting, Blue Bell, Earnest to Norristown, Devault, Penn., to Quarryville, Penn., (A) 9c, (B) 8c per 100 lb. Reason—to establish rates which will be comparable with those in force from York-Hanover district to Quarryville.

Proposed I. C. C. Reports

17789. Missouri Gravel Co. vs. Chicago, Burlington and Quincy R. R., et al. Rates on sand and gravel from La Grange, Mo., to points on C., B. & Q. in central Illinois not unreasonable. Rates from same points to same destinations on other lines unreasonable and prejudicial.

I. and S. 2762. Proposed increased rates on sand and gravel and crushed stone between Kansas and Oklahoma points not justified. Suspended schedules ordered cancelled and proceedings discontinued.

17412. Sand rates from Sirridge and Grinter, Kas., to destinations in Kansas City, Clay County, and St. Joseph Railway within switching limits not unduly prejudicial.

I. and S. 2763. Proposed change in rates on cement between Oklahoma and Texas points and between points in Texas over interstate routes and on shipments from Oklahoma to Arkansas, Louisiana and Mississippi destinations are not justified. Suspended schedules ordered cancelled and proceedings discontinued.

17422. Core sand rates from Provincetown, Mass., to Westfield, Mass., over interstate routes unreasonable, as they exceed 12.5 cents. Reparation ordered and new rate to be made, effective not later than February 28.

17796. Crushed stone rates from Thornton, Ill., to northern Indiana and southwestern Michigan destinations unreasonable. New basis proposed.

15715. New rates on sand from Lawrence, Kas., to points within 150 miles east of Kansas City, Mo., ordered into effect. Existing rates found to be unreasonable and prejudicial.

16184. Rate on sand from Lawrence to the Kansas City, Mo.-Kas., switching district unreasonable and unduly prejudicial to the extent it exceeded or may exceed, by more than 1 cent per 100 lb., the rates from points within the Kansas City switching limits and Muncie and Grinter, Kas., to points within that district. That revision, however, is to be made not later than February 28.

178717. Chicago Gravel Co. et al. vs. Atchison, Topeka and Santa Fe et al. and cases joined with it. Interstate rates on sand, gravel and crushed stone in and around the Chicago-Gary switching district and other points in northern Illinois, southern Wisconsin and eastern Iowa condemned unduly prejudicial and unduly preferential. New adjustment ordered.

I. and S. 2761. Proposed increased rates on phosphate rock from points in Florida pebble rock district to Roanoke, Ala., unjustified.

17517, I. and S. 2470, 17689. Rates on chert, clay, sand and gravel within the state of Georgia, and the cases joined with it (mimeographed). A basis of reasonable rates prescribed on the commodities mentioned, also slag, to be made effective not later than June 1, for interstate application, based on a single-line and joint-line set forth in the report, from Montgomery, Ala., and Chattanooga, Tenn., to destinations in Georgia and Mississippi, between points in Georgia and between points in Georgia and other points in southern territory, except points in Florida. It has also prescribed so-called short line arbitraries, to be applied over the rates prescribed for the standard lines.

Rates on gravel from Montgomery and Chattanooga to destinations in Georgia and Missisippi also unduly prejudicial to the extent they exceed, distance considered, rates contemporaneously maintained on slag from Birmingham and other Alabama points to the same destinations.

In I. and S. No. 2470, sand, gravel and slag from Alabama and Tennessee to points in Georgia, one of the cases joined with the commission-initiated case, it has found proposed increased rates on slag from Copperhill, Tenn., to points in Georgia not justified and directed the cancellation of the schedules, without prejudice to the establishment of rates on the basis of those found reasonable in the general inquiry. Intrastate rates in Mississippi (17689) do not result in undue prejudice to the complainants.

Plastoid Company Increases Output of Plant

DUE to the increasing demand for gypsum plaster lath for building purposes both in the Southland and throughout western United States, the Plastoid Products Co., Los Angeles, Calif., has doubled its working force and is now maintaining a continuous production of schedule, night and day, on a seven-day basis.

This statement was issued recently by Robert M. Greenleaf, vice-president and general manager of the company, to the Los Angeles *Times*. Additional workmen and new equipment, Mr. Greenleaf says, were added to the plant a short time ago to make the advance possible.

An important step toward increasing production was the installing of a large dry kiln.

In the December 11 issue of ROCK PRODUCTS, announcement was also made that in line with the company's expansion program, President Orville Routt had appointed Perry Jones as assistant general manager, and retained Doane Severance, chemist, as head of the research department.

Census of Wall Plaster, Wall Board, and Floor Composition Manufacture in 1925

THE Department of Commerce announces that, according to data collected at the biennial census of manufactures taken in 1926, the establishments engaged primarily in the manufacture of wall plaster, wall board and floor composition reported, for 1925, a total output valued at $90,957,045, an increase of 23.2% as compared with $73,800,539 for 1923, the last preceding census. The principal products of this industry are gypsum plaster and other ready-mixed wall plasters and similar preparations, such as hard wall plaster, plaster wainscoting, fiber plaster, stucco, calcined plaster, molding plaster, plaster board, asphalt mastic and ornamental plaster work for interior decoration, gypsum and other wall boards and floor composition.

In addition, wall plaster, wall board and floor composition were manufactured to some extent by establishments engaged primarily in other industries. The value of such commodities thus produced outside the industry proper in 1923 was $4,407,830, an amount equal to 6% of the total value of products reported for the industry as classified. The corresponding figures for 1925 have not yet been calculated, but will be included in the final report of the present census.

Of the 222 establishments reporting for 1925, 33 were located in California, 15 in Illinois, 11 in Iowa, 4 in Kansas, 14 in Michigan, 4 in Nevada, 8 in New Jersey, 41 in New York, 17 in Ohio, 10 in Pennsylvania, 5 in Texas, 5 in Washington and the remaining 55 in 24 other states.

The figures for 1925, as presented herewith, are preliminary and subject to such correction as may be found necessary upon further examination of the returns.

SUMMARY FOR THE INDUSTRY FOR THE UNITED STATES: 1925 AND 1923

	1925	1923	Per cent of inc.
Number of establishments	222	195	13.8
Wage earners (average number)*	10,977	9,289	18.2
Maximum month	June 11,276	Nov. 9,761	......
Minimum month	Jan. 9,875	Jan. 8,059	......
Per cent of maximum	87.6	82.6	......
Wages†	$16,078,362	$14,893,572	8.0
Cost of materials (including fuel and mill supplies)†	$39,553,463	$33,124,267	19.4
Value of products†	$90,957,045	$73,800,539	23.2
Value added by manufacture‡	$51,403,582	$40,676,272	26.4
Horsepower	82,863	62,520	32.5

*Not including salaried employes.

†The amount of manufacturers' profits cannot be calculated from the census figures, for the reason that no data are collected in regard to a number of items of expense, such as interest, rent, depreciation, taxes, insurance and advertising.

‡Value of products less cost of materials.

A New Gypsum Product

GYPSUM lath in bundles that are handled by the lather with at least the same ease that wood lath is handled was announced at the silver anniversary convention of the United States Gypsum Co. under the trade-name of bundled "Rocklath." Each bundle contains lath for the covering of 32 sq. ft. of wall and ceiling surface. The individual pieces of lath come in two sizes. One is 16x48 in. and of these there are six in a bundle. The other is 16x32 in. and of these there are nine in a bundle. Each bundle weighs 60 lb.

It was announced that bundled Rocklath was developed only after 14 months of investigation among the lathers and plasterers of 165 cities. The investigators went on to the jobs with the workmen to learn precisely what was wanted in the way of a plaster base. The data thus gathered was tabulated and correlated, and the final product, according to the announcement, is simply an attempt to give the lathing and plastering trades a product identical with their requirements.

Each piece of bundled Rocklath is ⅜ in. thick, has a three-ply nailing edge and can be plastered on either side. It also can be applied vertically in closets, corners and angles. The kraft paper covering is sufficiently porous to prevent slipping under the trowel while the plaster is being applied. Edges of the individual pieces are rounded to make for easy handling. The boards can be butted together, as tests recently conducted showed that the adhesion of gypsum plaster to plasterboard is greater than to any other type of lath. Consequently "keys" are not needed. If, however, it is a trade-custom to space the boards, this can be done, but the spacing should be a full ⅜ in. to give the joints a strength equal to the body of the wall.

According to the announcement, bundled Rocklath is virtually unbreakable in the bundle and is not subject to damage in the piece. It requires only half the number of nails required for wood lath over an equal area, and because of its pure gypsum core it can be scored as satisfactorily as it can be sawed. The bundles permit quick estimate by the contractor of the material on the job; easy transfer from room to room, and easy storage in the dealer's warehouse.

On 60-Gyratory Crushers!

THE attention of the editors has been called to an error in ROCK PRODUCTS, December 25, 1926, Annual Review Issue, p. 186, in the article on "Crushers and Crushing Machinery," where it is stated that: "The year 1926 has been notable for the construction of three new 60-in. gyratory crushers," etc. One of the crushers the writer had in mind when this sentence was written was that made by the Traylor Engінereing and Manufacturing Co. for a Michigan iron mine, and described in ROCK PRODUCTS, October 2, 1926, p. 87, as "one of the largest crushers ever built." (This same manufacturer has two 60-in. gyratories in operation in Michigan.)

It has since been learned that the crusher referred to could not be classed as a 60-in. machine, but as one of "the sturdiest and heaviest" 48-in. crushers yet built. Consequently it was ROCK PRODUCTS' error to place it in the same classification with the two new Allis-Chalmers Manufacturing Co.'s 60-in. gyratories, which were described and illustrated in some detail in the December 25 issue.

The editors regret the error, but believe it is excusable, as most of us always get into difficulties when we talk or write in superlatives; for after all, what is biggest and best today may be secondary to something else tomorrow. Anyhow, judging by this mis-step it is safer to judge the size of a gyratory crusher by its weight, rather than its opening!

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Ohio Block Men Discuss Building Codes

Meeting of Ohio Concrete Products Association

THE Ohio Concrete Products Association held its annual convention at the Niel House in Columbus, Ohio, January 25, 26 and 27. Eighty-five registered attendance, about half of these makers of blocks and other products and the remainder representing cement mills, the Portland Cement Association, machinery houses and allied industries. All these who attended have contributed financially to the support of the association and by a vote of the association taken at this convention were admitted to full membership provided the annual contributions equaled or exceeded the regular annual dues.

Other actions taken by the convention which may have an effect on the future of the industry were the endorsing of the proposed basic building code and the consideration of local codes and ordinances in towns and cities of the state. The fight for equal insurance rates with brick seems to have been won, according to the report made by V. Q. Galier, representing insurance interests. The question as to whether or not an exhibition shall be held at the next annual convention was given to a committee which is to report at least four months before the next convention to allow time for notifying proposed exhibitors. It is thought that the committee's report will favor an exhibition. The association voted to employ an attorney for advice and legal representation, retaining him by the year.

Members of the Association at Ohio State University

Ohio's Output of Concrete Products

A report from the Portland Cement Association quoted by R. C. McCall, one of its Ohio representatives, showed that the state's production of 8x8x16-in. standard block or equivalent in other building units was 31,000,000. In 1925 this was 26,000,000 and in 1925, 22,000,000. The production of 5x8x12-in. tile in 1926 was 2,000,000, and of brick 3,000,000. Roofing tile production was 22,000 and floor tile production 96,000. There were 1,400,000 ft. of silo staves made and sold. Trim stone, concrete pipe and miscellaneous products such as laundry trays, burial vaults and septic tanks used 60,000 tons of concrete.

Large as these figures seem, they show that there is plenty of room in Ohio for the industry to grow. The 31,000,000 block is less than 5% of the total production of the United States and Ohio has a much larger percentage of the population of the country not to speak of the high proportion of the country's wealth in its boundaries. There is also plenty of room for the association to grow. There are 600 makers of concrete products in Ohio, according to the report of the secretary, G. O. Friel, and only 100 are registered as members of the association. At this convention it was voted to begin a drive for members which should at least double the membership before the next convention.

Basic Building Code

Ohio recognized concrete block as a proper material for building school houses, churches, theaters and other places of public assembly by the famous House Bill 319 which passed the last legislature. But concrete building units are recognized as a general building material only in an indirect way. The state has a detailed building code passed in 1911 which represented the best practice of the time but which is now obsolete in certain sections. It attempted to specify everything completely—as, for example, the number of bolts there should be in a fire escape and their size. Such a rigid code was found unworkable as the building industry progressed and legislation gave the state a board of standards which has the right to declare certain materials the equivalent of other materials in certain forms of construction. Concrete building units are allowed under the ruling as equivalents of brick and some other materials.

The proposed state code which will probably be adopted by the legislature has been drawn by the board of standards and cuts down the number of sections required from 1000 to 31. It concerns itself with the results to be obtained from an engineering and sanitary viewpoint, leaving out consideration of methods and materials so far as possible. Under this new code concrete block or tile construction will be simply "masonry" construction and the finished wall

must be shown to have the power to resist defined stresses and to have some other characteristics. All other forms of masonry construction will be judged by the same standards.

The proposed code was pretty thoroughly explained by Mr. Donagher and P. C. Dempsey (who gave the legal view of the code), both members of the state board of standards, and J. R. Snowball with the Portland Cement Association. The members seemed to like the proposed code and the committee's report endorsing it was heartily adopted.

Building Ordinances

Bert Walters, building inspector for Columbus, described the Columbus ordinance applying to concrete building units and its working. He pointed out that while concrete block had been made in Columbus for 20 years, it was only in the last three years, since the ordinance was adopted, that the industry became stabilized. And the great increase in the use of block had come in that time. Mr. Walters heartily approved a licensing system for block makers.

Frank Owen, vice-president

He explained that the Columbus ordinance calls for a strength of 1000 lb. per square inch in compression. Samples are taken directly from the machine, three from each plant, at least once in six months, and sealed. These are cured in the regular way and tested in the laboratory of the State University. The members would see this done during the inspection trip to the laboratory on Thursday afternoon. Certificates are issued as a result of tests.

G. R. Hauser, building inspector of Cincinnati, followed. He explained that the Cincinnati method was to issue a certificate of quality to a plant if its product met the required tests of strength and absorbtion. If the plant changed hands the certificate was still good so long as the regular inspection showed no change in the product. He thought the certificate plan better than licensing. In its essentials the Cincinnati ordinance is like the Columbus ordinance. Blocks have been raised to a high standard of quality since the ordinance was passed.

Mr. Hauser thought the standard for concrete blocks was too high. "Ordinarily I would say that I would not have a house built of materials that just passed building code standards, but this does not apply to concrete block, for which our Cincinnati standard is higher than it needs to be," was the way he put it.

He believes the day is coming when inspection will be applied not only to materials but to construction and he wanted to see "certified houses" as well as certified materials. The public should be educated to this. Appreciating the difficulty block makers have in getting blocks laid properly, and with the right kind of mortar, the audience applauded this. Mr. Hauser said the greatest difficulty was to have the ordinary single family dwelling house built well, as no architects were employed for these; there was no inspection and often the owner never saw the house before it was finished and placed on the market for sale.

Bert C. Westover, Indianapolis, Ind., building commissioner, was present as a guest and asked to tell of the ordinance in his city. He said it was largely a copy of the Cincinnati ordinance except that blocks were required to test only 800 lb. instead of 1000 lb. To show how the block makers met this requirement he said that recently the product of 19 Indianapolis makers tested 1000 lb. or over, the blocks of three companies tested just over 800 lb. and nine of the blocks submitted by other companies were so strong that the 200,000 lb. testing machine could not break them.

Indianapolis builders, he said, were getting wonderful results with "California" stucco, a product that apparently had come to stay. The city has 31 block makers who are well organized.

Dayton Needs a New Ordinance

O. W. Nichols of Dayton reported an unsatisfactory condition there. The present ordinance admitted the use of 12-in. blocks for foundations, now no longer made. The first building inspector in the city was unfavorable to concrete building units. His successor, the present inspector, was fair to concrete blocks but the ordinance was not satisfactory. So only 4000 block were made daily in and around Dayton. These were used outside the city limits and if the limits are extended to take in the districts where block are used the block makers will have to go out of business. A little pressure from the association he thought would be sufficient to have a satisfactory ordinance passed.

G. D. Moody, Dresden and Zanesville, speaking for Zanesville, said that an ordinance had just been passed establishing a 1000-lb. specification for concrete block as the result of a long continued effort on the part of some of the block makers. "Now the others will have to put cement enough in the block to make it hold together," he said. R. C. McCall also spoke of the Zanesville situation and said there was still something to be done there, as interests inimical to block were at work and the city was about to pass a fire ordinance which was a building code in embryo. W. M. Julian spoke of codes pending in Hamilton and other cities. Codes, he said, are urgently needed. There are some cities where not many products are made, but eventually all will use a lot of concrete blocks and should have codes permitting such use. He said the Portland Cement Association was willing to help block manufacturers with any of their problems, including that of seeing that a fair local building ordinance was adopted.

How a Bad Building Code Works

To show the bad effect of the rigid code at present in effect in Ohio, J. R. Snowball related the experience of a man who built a building for dry-cleaning garments in Montpelier. This man did all he could to find out whether or not the state code permitted concrete block construction for such buildings and was definitely informed by a deputy state fire marshal that concrete block were permissible in such structures. The state fire marshal was out of the state at the time; on his return he reversed his deputy's ruling and said that the walls (which had been put up in his absence) must be torn down and rebuilt of brick. An appeal was made to the proper state authorities and after a long and expensive wait it was finally decided that an operating permit could be granted, but the case was not allowed to be used as a precedent and hereafter such buildings may not be built of concrete block until the building code is changed.

Cinder Blocks

F. J. Straub, inventor of the cinder block (most cinder block plants in the United States are operated under the Straub patents) is a member of the association and was present at the convention. A discussion of cinder block came from a question asked him by Mr. Walters, building inspector of Columbus, who wanted to know why cinder block should be allowed to pass with 700 lb. compressive strength while ordinary block, made with crushed stone or pea gravel, had to pass 1000 lb. The gist of Mr. Straub's reply was that a 1000-lb. requirement would not be fair to the cinder block. This was introduced primarily as a curtain wall block in large buildings to compete with light weight materials, especially gypsum blocks. Strength was not so much needed as some other qualities. It is easy enough, he said, to make a cinder block to meet the 1000-lb. requirement, but such a block is hardly "nailable" and loses in "cutability" and sound proofing qualities. So far as strength is concerned, the 700-lb. requirement has been declared to be strong enough by important specification making bodies.

G. O. Friel, secretary

Mr. Walters admitted that this was true, as regards national specifications, but said

that so long as Columbus had a 1000-lb. requirement for block made of one kind of aggregate he could see no logical reason for giving a lesser requirement to a block made of another aggregate. The discussion ended with this.

Abstracts of Papers

While most of the speakers talked informally, there were a few formal papers presented. One of these, "Concrete Building Tile," by C. L. Bourne, engineer with the Consolidated Cement Corp., Cement City, Mich., is to be printed in full in a forthcoming issue so it will not be abstracted here. The same is true of a paper on "Concrete Pipe," presented by C. H. Bullen, of the Midwest Concrete Products Co., Chicago. Both papers were full of "meat" and listened to attentively. It surprised at least one of Mr. Bullen's hearers to learn that a 6-in. pipe made in a tamping machine without centrifugal action would withstand 106 lb. hydrostatic pressure. Mr. Bourne's paper was not discussed, but in the talk of certain groups it was judged that some members did not favor the tendency toward the use of tile in the place of the standard block. One member had figured out that with tile at $70 per thousand and blocks at 21 cents each, the amount received per pound of concrete was slightly less and there was an additional cost for handling.

Art in Concrete

"Art in Concrete" was the title of an excellent paper by Robert Havlik, who is so well known from his work at Mooseheart, Ill. It was read by Roe E. Withrow, as Mr. Havlik was unable to be present. It began by saying that concrete building units were introduced by engineers and mechanics who were not artists and the development of the artistic side of concrete had to come later. Until 15 years ago cast stone could not get a hearing from architects, but now bids are asked for it whenever an important structure is going up.

Every building has to be treated as an individual unit and the cast stone furnished to meet the architect's designs. In New York, Philadelphia and Chicago some of the most important buildings erected recently contain cast stone and architects use it as freely as natural stone. Mr. Havlik predicted that in the next decade it would become the most popular material for the better class of structures.

The paper compared the relative merits of the wet poured and dry tamped methods of making cast stone and said that with proper aggregate the wet process was easier and there was less danger of checking. The product was more uniform with the wet method than the dry.

The high cost of building has been a great boon to the cast stone industry. While at present the amount used is small as compared with cut natural stone and terra cotta, it is increasing and the field for the future is very wide.

Regarding the business side of the industry, the paper said that the ordinary job would run from $10,000 to $25,000. One recent building in Chicago contained more than $200,000 worth of cast stone. The method employed was to set up the model in clay and make glue molds and the greatest saving could be shown where a design had to be repeated on a number of pieces.

Mr. Havlik's paper occasioned some discussion, especially one sentence which was to the effect that ordinary concrete building units were not used in the better class of buildings. Exception was taken to this and examples were mentioned of residences of the highest class constructed of concrete blocks and cement stucco.

Manufacture of Special Products

The manufacture of special products was discussed by various members of the association. H. E. Ledyard described the method of making air-sealed burial vaults in which his firm, the Ashland Vault Co., specializes. They are made in steel molds with 1-in. walls reinforced. Cemeteries generally prefer them to steel vaults because there is less danger of collapsing, leaving a sunken grave to be filled up, although some cemeteries penalize the concrete vault, as they have contracts with the makers of natural stone vaults. Vaults are not a shipping proposition; a radius of 50 miles is about the limit of the market.

Septic tanks are made 30x84x24 in. and must conform to a state law.

Mr. Ledyard said that the manufacturers of other products than block and tile had their own problems and thought that some consideration should be given these by the association. He suggested a branch or division of the association devoted to the manufacturers of vaults, laundry trays, septic tanks and the like which could have the force of the whole association behind it when this was needed. It was voted to write all manufacturers of these products to ask them to join the association with such an end in view.

"Roofing Tile" was the subject of a talk by Otto Walter of Perryville, Ind. He said flatly that concrete tile was better than any other kind of roofing and gave his reasons for such a belief. Tests on water-resistant and fire-resistant qualities had been thoroughly satisfactory and now that good coloring material can be obtained (since the war) the colors are uniform and permanent. He warned his hearers who expected to go into the business to buy nothing but the best grades of coloring material if they wanted a permanent job.

He told a story to illustrate the value of a concrete tile roof to a house, giving his experience with a speculative builder who allowed him to put on a tile roof with some misgivings. The house cost $250 more on account of the tile roof, but it sold for $500 more and was the first house to sell of the lot offered. "The roof sells the house," was this builder's judgment, who now uses only concrete tile roofs on his houses.

"Concrete Mantels" was the subject of discussion by G. D. Moody, of Moody Bros., Dresden. These are made to represent brick laid up with ⅜-in. joints. In the beginning of the business his firm made a number of styles and colors, but now they make only two styles and two colors and are able to satisfy customers with one of these.

The mantel is made in six pieces so that no piece is too large to be handled easily in erecting. One-piece mantels have been made, in fact there is still one firm in an adjoining state that makes them, but they are very heavy and awkward to handle and erect.

Future of Concrete Building Units

One of the most interesting and inspiring talks was given by W. D. M. Allen, who is with the Portland Cement Association, on the present status of the concrete building unit industry and its probable future.

Eight years ago Mr. Allen visited 453 plants for the Portland Cement Association and found only five power driven plants, the remainder employing hand tamped machines. Today the proportion is reversed and many of the large manufacturers have not sold a hand tamping machine for some time. The block of eight years ago were of 200-, 300- and 500-lb. concrete; 500-lb. concrete was exceptionally good. There were no specifications anywhere at that time, but now we have the Hoover code, the A. C. I. specifications and others that are nationally accepted.

The present tendency is toward lighter weight, and this has manifested itself in two ways. One is the selection of a lighter weight unit, the tile in the place of the block, and the other is the selection of a lighter weight aggregate such as slag, cinders and "Haydite."

In 1926 it is estimated that 7,500,000,000 common clay brick were made and the equivalent of 5,000,000,000 brick in clay tile. In the same year the equivalent of 8,400,000,000 brick were made in concrete building units. The value of the concrete units is estimated to be $140,000,000 and they were made in 8000 plants.

The present state of the industry shows a long advance in eight years, but it is believed that the growth of the concrete building unit industry has only begun. Mr. Allen said he expected that in 1930 the equivalent of 1,200,000,000 standard block would be made and used. This would come partly as a result of better and more economic methods of manufacture.

Mr. Allen said that he believed prices of concrete building units would fall. At present they are fixed at a point where the inefficient manufacturer can remain in business, but consolidation and the inclusion of more capital and the adoption of more effi-

cient methods is bound to lower production costs. This will be reflected in the selling price. There will be a better price differential between concrete and other building units and so more concrete units will be sold.

He mentioned the quite recently reported consolidation of plants in Pittsburgh, which will make 8,000,000 to 9,000,000 block per year, as an example of what is going on in the industry. This consolidation has a research department which is working to get the cost of block in the yard to the lowest possible point consistent with maintaining the quality.

Better merchandising methods are necessary. He had often been asked by block makers and those intending to be block makers what was the best machine for a plant and he always answered a Ford coupe. The plant product must be sold and the plant salesman must get around to see prospective customers. He must also put "sales brains" into the work. The finished building should be "sold" to the customer.

It is essential that the block manufacturers see that the product is properly laid in the wall. Concrete block structures that failed in the Florida hurricane were those in which the blocks were laid up with a mortar composed of one part of lime to five or six parts of seasand. Such a mortar has almost no strength.

Masons insist on a fat mortar. For that reason the mortar now recommended for concrete building units is one that contains one sack of cement, one of hydrated lime and 1 cu. ft. of sand. This has been proven sufficiently strong. Blocks should be *dry* when laid. There has been much controversy on this point, but it is determined now that the block should be dry and if it is very dry the faces should be dampened only enough to keep the water from being soaked out of the mortar.

Testing Concrete Blocks

A. J. Braden, who has charge of the testing of blocks at the Ohio State University, gave a very practical talk on the relation of testing the product to the industry. He first described briefly the machines and the testing method used. Capping the block is an important point. The most satisfactory capping he had found was one that was half cement and half plaster of paris. This sets more quickly than neat cement and it is strong enough, as a cap of this mixture had never been known to slip.

He advised block makers to be sure that the sample chosen for test was a fair one. All loose pieces of aggregate such as pea gravel should be brushed from the faces. The block should not be dried out by putting it close to a hot radiator, as that would weaken it.

The appearance of the block after testing gives important information. If one end breaks to small pieces it shows that the tampers are not striking as hard at that end as at the other. If the top sloughs off it shows that too much is put in the mold before tamping begins. A bad mix is shown by a ragged granular fracture. Too much coarse stone or gravel may make a weak spot through which the breaking will occur at a lower compression than the rest of the block would withstand.

The members visited the laboratory on the third day of the convention and saw blocks broken as part of the routine testing work carried on under the Columbus ordinance. The ordinance, it will be remembered, calls for 1000-lb. concrete. The strengths disclosed by the test were 1210 lb., 1470 lb., 2450 lb. and 1950 lb.

Business Sessions

All the sessions were presided over by Frank A. Owen, of the Owen Concrete Products Co., Akron, who is vice-president of the association. President S. L. Crew of Cincinnati was unable to be present.

The financial report was read by Miss K. E. Friel and it showed the association to have a sufficient bank balance to go on with, and to meet the new expenditures provided for in the program.

The reports of the committees have been mentioned in preceding paragraphs. All the officers were re-elected and G. O. Friel, the secretary, whose untiring efforts have been mainly responsible for the success of the association, was continued in his office. The next convention of the association will be held in Cincinnati.

Registration

Frank A. Owen, Owen Concrete Products Co., Akron.
L. D. Hagerty and J. M. Swickard, Cunard Lang Co., Columbus.
Al C. Dale, Al C. Dale Co., Columbus.
Paul L. Plato, Lorain Crystal Ice Co., Lorain.
Ferd Ritter, Jr., Ferd Ritter, Jr., Cincinnati.
W. S. Taylor, W. S. Taylor Crate Co., South Zanesville.
F. K. Straub, Straub Block Co., Warren.
Oscar A. Schlichting, O. A. Schlichting Co., Rossford.
Joseph Nagey, Columbia Concrete Co., Toledo.
Paul Schmitte and Rob Schmitte, Schmitte Bros. Cement Block Co., Columbus.
H. E. Ledyard and Clarence McKellogg, Ashland Vault Co., Inc., Ashland.
F. H. Moore, Moore Bros., Elyria.
Paul M. Cunningham, Northern Granite & Stone Co., Cleveland.
E. L. Maag, Ohio Concrete Sewer Pipe Co., Chillicothe.
Theodora A. Dorner, F. Dorner & Sons Co., Lafayette, Ind.
G. F. Potter, G. F. Potter, Cincinnati.
E. W. Deinhart, Acme Concrete Products and Gravel Co., Cement City, Mich.
W. R. Stewart and Dave Silver, Stewart & Silver, Columbus.
L. A. Kinsley, Eden Gravel Co., Upper Sandusky.
Chester C. Elliot, Piqua Concrete Products Co., Piqua.
Otto Walter, Perrysville, Ind.
Edwin Steubing, Steubing Cowan Co., Cincinnati.
W. K. Clark, Cincinnati Concrete Co., Cincinnati.
H. W. Forste, Oakley Concrete Block, Oakley, Cincinnati.
Wm. F. Koenig, Wm. F. Koenig, Cincinnati.
W. H. Kulp, F. E. Kulp and J. J. Kulp, Kulp Bros. Brick Co., Columbus.
R. D. Robertson, Independent Concrete Pipe Co., Indianapolis, Ind.
O. W. Nichols, Nichols Concrete Block Co., Dayton.
Harry Richter, Richter Concrete Works, Columbus.
H. Simms, Newport, Ky.
W. M. Julian and D. H. Buxton, Wyeth-Scott Co., Newark.
J. B. McJunkin, Bessemer Limestone and Cement Co., Youngstown.
H. J. Schmitz and Robert Schmitz, Schmitz Cement Block Co., Ashland.
Robert Simms, Iron Clad Concrete Co., Newport, Ky.
G. D. Moody, Moody Bros., Dresden.
W. J. Pabst, Hamilton Gravel Co., Hamilton.
C. D. Clagston, Southwestern Portland Cement Co., Dayton.
G. L. Showalter, Attica Lumber Co., Attica.
Bill Wade, Camp Chase Block Co., Columbus.
C. H. Bullen, Midwest Concrete Products Co., Chicago, Ill.
R. C. McCall, J. R. Snowball, R. L. Brown, T. J. Schoenlaub and R. D. Livingstone, Portland Cement Assn., Columbus.
W. D. M. Allan, Portland Cement Assn., Chicago, Ill.
H. J. McDaregh, Portland Cement Assn., Indianapolis, Ind.
F. M. Wylie, V. N. Connar, J. C. McClure, Universal Portland Cement Co., Chicago, Ill.
G. C. Lucas, Benj. Jones and C. J. McDowell, Alpha Cement Co., Ironton.
F. B. Peters, O. L. Heckelman and Roe E. Withrow, Sandusky Cement Co., Cleveland.
C. L. Bourne, Consolidated Cement Corp., Cement City, Mich.
H. L. Sorders and Clem Beals, Springfield Cement Co., Springfield.
F. F. Green, Miami Cement Co., Dayton.
H. B. Weiser and M. J. Schunor, Standard Portland Cement Co., Cleveland.
S. Mapel, Pittsburgh Plate Glass Co., Pittsburgh, Penn.
F. J. Boland, W. G. Hayes and F. J. Boland, Independent Portland Cement Co., Columbus.
F. V. O'Neal, Southwestern Cement Co., Dayton.
R. G. Former, Columbia Portland Cement Co., Zanesville.
H. J. Orthoefer and H. O. Grant, Wabash Portland Cement Co.. Dayton.
George Atherton and W. A. Gruenberg, Besser Sales Co., Chicago, Ill.
N. Ransohoff, R. Neihaus and A. H. Van Cleef, Ideal Concrete Mch. Co., Cincinnati.
P. S. Kelley and Hoakon Paulson, Anchor Concrete Machinery Co., Minneapolis, Minn.
P. G. Seligman, Wellston Iron Furnace, Jackson.
L. H. Titus and Louis M. Laue, Truscon Steel Co., Youngstown.
J. H. Walker, Pittsburgh Plate Glass Co., Columbus.
R. O'Neal, Concrete Machinery Co., Detroit, Mich.
H. J. Quirk, Chase Fdy. & Mfg. Co., Columbus.
Bert Walter, Building Inspector, Columbus.
Bert G. Westover, Building Commissioner, Indianapolis, Ind.
George R. Hauser, Building Commissioner, Cincinnati.
S. K. Robinson, City Building Inspector, Columbus.
V. Q. Galier, V. Q. Galier, Columbus.
A. B. Braden, Ohio State University, Columbus.
Edmond Shaw, Rock Products, Chicago, Ill.
F. C. McLaughlin, Kent Machine Co., Kent.

Northwest Products Men Hold Convention at Seattle

PRACTICAL discussions of problems of paramount importance to the cement products industry occupied the attention of members of the Northwest Concrete Products Association when they met on January 21 and 22 at the Gowman Hotel, Seattle, Wash., for the second annual convention.

Some of the speakers included:

Ira S. Collier, professor of civil engineering, University of Washington; Bailey Tremper, state highway testing laboratory, Olympia; J. A. Fallgreen, city engineer, Auburn, Wash.; A. J. R. Curtis, assistant general manager, Portland Cement Association, Chicago; H. F. Faulkner, city testing laboratory, Seattle; H. A. Ambler, Superior Portland Cement, Inc., on three-day concrete; Harlan Thomas, architect, Seattle; C. P. Bates, insurance rates; A. W. G. Clark, B. C. Concrete Co., Ltd., on centrifugal pipe; Minor Merriwether, Concrete Structural Units Co., Seattle, and several others.

Approximately 75 representatives of the industry attended the convention. The membership committee stated that the association now has 41 members in the Northwest territory.

Work to Start on Washington Agstone Plant

THE Washington Agricultural Chemical Co., Sedro-Woolley, Wash., will start work at once getting the lime fertilizer plant it has been contemplating ready for operation, according to the Bellingham (Wash.) *Herald*. What is known locally as the old Shrewsbury mill will be used. This building will be remodeled and equipped with new machinery. Orders for grinding equipment for the manufacture of agricultural limestone were placed by the company some months ago, as announced in the September 4 issue of ROCK PRODUCTS.

When ready for operation the plant, on single shift, it is said, will have a capacity of three carloads of agstone a week, but this will be increased to a carload a day after a night shift is run, as it is expected will be done later.

H. M. Eakin, soil expert, is president of the company; E. P. Jech, secretary, and Q. R. Bingham, treasurer.

Rome, Georgia, May Have Sand and Gravel Plant

IF plans now under contemplation by a group of Rome, Ga., business men are carried out, a sand and gravel plant will be erected in that city within the near future, according to the Rome (Ga.) *News-Tribune*. The project is being promoted by B. Houser, naval architect. Mr. Houser hopes to get the new company organized shortly. Plans and specifications for a sand dredging plant to be operated on local rivers have already been submitted by him, it is said.

The plant designed by Mr. Houser calls for the most modern type, and will have a capacity of 800 tons of sand and gravel per day. He estimates that it will take about 60 days to complete the plant and put it in operation.

Kentucky Rock Asphalt Co. Loses Two Barges

TWO barges heavily loaded with rock asphalt belonging to the Kentucky Rock Asphalt Co., Louisville, filled with water, broke loose from the towing steamer and sank in 30 ft. of water recently in the flooded Barren river near Bowling Green.

The accident occurred when the barges were being towed over the spillway at the locks. At the time there was a difference of 4 in. in the water level below and above the dam, and the water poured over the front end of the barges.

The loss on the barges and asphalt is estimated at about $10,000. According to an official communication received from W. H. Tarvin, president of the company, however, the barges undoubtedly will be recovered without much damage, although the cargo, worth at least $5000, may be lost.

Mr. Tarvin adds that the company tows more than 200,000 tons annually from Kyrock to Bowling Green, and this is the first accident of the kind in years.

J. R. Thoenen Now in Greece

J. R. THOENEN, consulting engineer to the rock products industry, is now engaged in special limestone mining work at the Martia mines of the Magnesia Cement

J. R. Thoenen

and Carbonic Gas Co., Aglia Anna, Euboea, Greece. The particular problems with which Mr. Thoenen will be concerned will require his remaining in Greece for about six months.

Quite recently Mr. Thoenen was engaged in gathering test data on the use of the wire saw in cutting slate. This investigation was under the direction of the Non-Metallic Mineral Station of the U. S. Bureau of Mines and sponsored by the National Slate Association.

National Lime and Stone Names New Officers

THE new officers and department heads of the National Lime and Stone Co., Findlay, Ohio, which was recently formed as a result of the merger of the old National Lime and Stone Co., Carey, Ohio; National Quarries Co., Lima, Ohio, and the Bluffton-Lewisburg Stone Co., Lewisburg, Ohio, have been announced. The details of this consolidation were reported in the January 22 issue of ROCK PRODUCTS.

The new officers are:

Chairman of the board, I. N. Bushong; president, Allen Patterson; vice-president, E. C. Edwards; second vice-president, Fred Patterson; treasurer and general manager, R. G. Spencer; secretary and manager of stone sales, J. R. Yearwood; assistant general manager and manager of lime sales, L. G. Love; general superintendent of plants, Fred Patterson, and traffic manager, W. D. Goble.

Pennsylvania Stone Producers Elect Officers

AT the recent meeting of the Pennsylvania Stone Producers Association held in the William Penn hotel at Pittsburgh, Penn., William M. Andrews of the Lake Erie Limestone Co., Youngstown, Ohio, was elected president; F. C. McKee of the West Penn Cement Co., Pittsburgh, Penn., vice-president, and J. C. King of the Carbon Limestone Co., Youngstown, Ohio, secretary-treasurer.

Midwestern Power Conference to Be Held in Chicago

THE second annual Midwestern Exposition and Power Conference will be held in Chicago, February 15 to 19, inclusive, at the Coliseum, which has been taken over in its entirety to provide ample space for the increased number and variety of exhibits and to permit uninterrupted meetings at which leading minds of the industry will deliver important addresses.

It is expected that fully 260 manufacturing companies will exhibit their products at the power show. A feature addition to the show is the second annual power conference which is to be held under the auspices of the local, regional and professional divisions of the American Society of Mechanical Engineers, American Institute of Mining Engineers, National Electric Light Association, Western Society of Engineers, National Safety Council and the American Institute of Electrical Engineers.

Fully 2000 power representatives are expected to be present, as well as over 50,000 engineers and others from all parts of the country. Present plans call for five sessions and a series of sight-seeing trips to important plants in the Chicago territory, so that virtually every moment from the opening on February 15 to the closing on the evening of February 19 will be filled with interesting and profitable activities.

The exposition and conference form a great educational enterprise, for engineers tied with ties of interlocking interests are provided with an opportunity to exchange ideas; they have a chance to study and solve the new problems of a fast-advancing industry. They are afforded an opportunity to hear the exposition of ideas by the master minds of the world of power, while of equal importance is the chance to see, examine and have explained the nature and functions of the great array of products and working models exhibited by manufacturers. Every exhibitor will have technical men on the ground to supply needed information.

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chaumont, N. Y.	.50	1.75	1.75	1.50	1.50	1.50
Chazy, N. Y.	.75	....	1.60	1.30	1.30	1.30
Danbury, Conn.	2.25	2.25	2.00	1.75	1.50	....
Dundas, Ont.	.53	1.05	1.05	.90	.90	.90
Frederick, Md.	.50@ .75	1.20@1.30	1.15@1.25	1.10@1.15	1.10@1.15	1.05@1.10
Munns, N. Y.	1.00	1.50	1.50	1.25	....	....
Northern New Jersey	1.60	1.50@1.80	1.30@2.00	1.40@1.60	1.40@1.60	....
Prospect, N. Y.	1.00	1.50	1.40	1.30	1.30	....
Walford, Penn.	.70	....	1.35h	....	....	....
Watertown, N. Y.	1.00	....	1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL						
Alton, Ill.	1.85	....	1.85	....	....	....
Bloomville, Middlepoint, Dunkirk, Bellevue, Waterville, No. Baltimore, Holland, Kenton, New Paris, Ohio; Monroe, Mich.; Huntington, Bluffton, Ind.	1.00	1.10	1.10	1.00	1.00	1.00
Buffalo, Iowa	1.10	....	1.40	1.20	1.25	1.25
Chasco, Ill.	1.00@1.30	....	1.00@1.15	....	1.00@1.15	....
Columbia, Krause, Valmeyer, Ill.	1.10@1.50	1.10@1.25	1.20@1.35	1.10@1.35	1.10@1.35	‖1.25
Flux (Valmeyer)	1.10@1.50	....	....	1.75	....	1.75
Greencastle, Ind.	1.25	1.25	1.15	1.05	.95	.95
Lannon, Wis.	.80	1.00	1.00	.90	.90	.90
Linwood and Buffalo, Ia.	1.10	....	1.30	1.20	1.25	1.25
McCook, Ill.	1.00	1.25	1.25	1.25	1.25	1.25
Milltown, Ind.	....	90@1.10	.90@1.15	.90@1.00	.85@.90	.85@.90
River Rouge, Mich.	1.20	1.20	1.20	1.20	1.20	1.20
Montreal, Que.	.75	1.30@1.45	1.15	.90	.85	1.00
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	1.10
Toledo, Ohio	1.60	1.70	1.70	1.60	1.60	1.60
Toronto, Ont.	1.55	2.05	2.05	1.90	1.90	1.90
Stone City, Iowa	.75	....	†1.10	1.05	1.00	....
Waukesha, Wis.	.90	.90	.90	.90	.90	.90
Wisconsin Points	.50	....	1.00	.90	.90	....
SOUTHERN:						
Alderson, W. Va.	.50	1.45	1.35	1.25	1.15	1.10
Atlas, Ky.	.50	1.00	1.00	1.00	1.00	1.00
Brooksville, Fla.	.75	....	2.65	2.65	2.40	2.00
Chico, Tex.	1.00	1.35	1.25	1.20	1.10	1.00
El Paso, Tex.	1.00	1.00	1.00	1.00	....	....
Ft. Springs, W. Va.	.50	1.35	1.35	1.20	1.20	....
Graystone, Ala.	Crusher run, 1.00 per ton					
Kendrick and Santos, Fla.	3½ in. and less, 1.00 per ton					
Ladds, Ga.	....	....	1.50	1.35	1.15	....
New Braunfels, Tex.	.60	1.25	1.10	.90	.90	.90
Rocky Point, Va.	.50@ .75	1.40@1.60	1.30@1.40	1.15@1.35	1.10@1.20	1.00@1.05
WESTERN:						
Atchison, Kans.	.25	1.90	1.90	1.90	1.90	1.80
Blue Springs & Wymore, Neb.	.25	1.45	1.45	1.35c	1.25d	1.20
Kansas City, Mo.	.75	1.50	1.50	1.50	1.50	1.50
Rock Hill, St. Louis Co., Mo.	1.35	1.35	1.35	1.25	1.25	1.25

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.80	1.70	1.45	1.20	1.05	....
Duluth, Minn.	.90	2.25	1.90	1.50	1.35	1.35
Dwight, Calif.	1.00	1.00	1.00	.90	.90	....
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Tex.	2.50	2.25	1.55	1.35	1.25	1.25
New Haven, New Britain, Meriden and Wallingford, Conn.	.80	1.70	1.45	1.20	1.05	....
Oakland and El Cerito, Cal.	1.00	1.00	1.00	.90	.90	....
Richmond, Calif.	.75	....	1.00	1.00	1.00	....
San Diego, Calif.	....	2.75	2.55	2.35	2.35	....
Springfield, N. J.	2.00	2.10	2.10	1.70	1.60	1.60
Toronto, Ont.	....	3.58@4.05	3.05@3.80	....	....	....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	1.40	1.40	....
Coldwater, N. Y.—Dolomite			1.50 all sizes			
Columbia, S. C.	....	2.00	1.75	1.75	1.60	....
Eastern, Penn.—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Penn.—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Lithonia, Ga.	.75	2.00b	1.75	1.40	1.30	1.25
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	....
Middlebrook, Mo.	3.00@3.50	....	2.00@2.25	2.00@2.25	....	1.25@3.00
Richmond, Calif.—Quartzite	.75	....	1.00	1.00	1.00	....
Somerset, Penn. (sand-rock)			1.50 to 1.85			
Toccoa, Ga.	....	....	1.40	1.25	1.25	1.25

*Cubic yd. †1 in. and less. ‡Two grades. ‖Rip rap per ton. (a) Sand. (b) to ⅛ in. (c) 1 in., 1.40. (d) 2 in., 1.3[illegible] (e) Dust. (f) ¼ in. (h) less 10c discount. (i) 1 in., 1.40.

Agricultural Limestone

(Pulverized)

Alderson, W. Va. — Analysis, 90% $CaCO_3$; 50% thru 50 mesh	1.50
Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 90% thru 100 mesh	4.00
Asheville, N. C. — Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200-lb. burlap bag, 4.00; bulk	2.75
Atlas, Ky.—90% thru 100 mesh	2.00
50% thru 100 mesh	1.00
Bettendorf and Moline, Ill.—Analysis, $CaCO_3$, 97%; 2% $MgCO_3$; 50% thru 100 mesh, 1.50; 50% thru 4 mesh	1.50
Blackwater, Mo.—100% thru 4 mesh	1.00
Branchton and Osborne, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh. (Less 50 cents commission to dealers)	5.00
Chaumont, N. Y.—Pulverized limestone. bags, 4.00; bulk	2.50
Chico, Tex.—50% thru 50 mesh, 2.50; 90% thru 4 mesh	1.75
Colton, Calif.—Analysis 90% $CaCO_3$, bulk	4.00
Cypress, Ill.—90% thru 100 mesh	1.35
Ft. Springs, W. Va.—50% thru 4 mesh	1.50
Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$; 75% thru 100 mesh; sacked	5.00
Hot Springs and Greensboro, N. C.—Analysis, $CaCO_3$, 98-99%; $MgCO_3$, 42%; pulverized; 67% thru 200 mesh, bags	3.95
Bulk	2.70
(Paving dust)—80% thru 200 mesh, bags	4.25@ 4.75
Bulk	3.00@ 3.50
Jamesville, N. Y.—Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.25; bulk	2.75
Joliet, Ill.—90% thru 100-mesh	4.25
Knoxville, Tenn.—80% thru 200 mesh, 3.00; 80% thru 100 mesh, bulk	2.70
Ladds, Ga. — Analysis, $CaCO_3$, 58%; $MgCO_3$, 32%; pulverized; 50% thru 50 mesh	1.50@ 2.50
Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.00; bulk	3.50
Marion, Va. — Analysis, 90% $CaCO_3$, pulverized, per ton	2.00
Middlebury, Vt.—99% thru 50 mesh, 50% thru 200 mesh	2.00
Milltown, Ind.—Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk	1.35@ 1.60
Olive Hill, Ky.—90% thru 4 mesh	1.00
Piqua, Ohio—Total neutralizing power 95.3%: 99% thru 10, 60% thru 50; 50% thru 100	2.50@ 2.75
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk	3.60
99% thru 100, 85% thru 200; bags, 7.00; bulk	5.50
Rocky Point, Va.—Analysis, $CaCO_3$, 95%; 50% thru 200 mesh, burlap bags, 3.50; paper, 3.25; bulk	2.00
Syracuse, N. Y. — Analysis, 89% $CaCO_3$; $MgCO_3$, 4%; bags, 4.25; bulk	2.75
Toledo, Ohio. 30% through 50 mesh	2.25
Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh	2.30
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk	2.50
West Stockbridge, Mass. — Analysis 90% $CaCO_3$, 50% thru 100 mesh; cloth bags, 4.75; paper, 4.25; bulk	3.25

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 50% thru 4 mesh	3.00
Atlas, Ky.—90% thru 4 mesh	1.00
Bedford, Ind.—Analysis, 98.5% $CaCO_3$, 0.5% $MgCO_3$; 90% thru 10 mesh	1.50
Brandon and Middlebury, Vt.—Pulverized, bags, 5.50; bulk	3.50

(Continued on next page)

Agricultural Limestone

Bridgeport and Chico, Texas—Analysis, 94% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh	1.75
50% thru 4 mesh	1.50
Chicago, Ill.—50% thru 100 mesh; 90% thru 4 mesh	.80
Columbia. Krause. Valmeyer. Ill.—Analysis, 90% $CaCO_3$; 100% thru 4 mesh	1.10@ 1.50
Cypress, Ill.—90% thru 50 mesh, 50% thru 100 mesh, 90% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh	1.35
Danbury, Conn.—Analysis, 79% $CaCO_3$, 11% $MgCO_3$; 60% thru 100 mesh; 80% thru 50 mesh; 100% thru 4 mesh; bags, 4.25; bulk	3.25
Dundas, Ont.—Analysis. 53.8% $CaCO_3$; $MgCO_3$, 43.3%; 50% thru 50 mesh	1.00
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh	1.50
Kansas City, Mo.—50% thru 100 mesh	.75
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% through 10 mesh; 46% through 60 mesh	2.00
Screenings (¼ in. to dust)	1.00
Marblehead, Ohio.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$, 32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk	1.60
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 50% thru 50 mesh	1.85@ 2.35
McCook, Ill.—90% thru 4 mesh	.90
Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind.—Analysis, 42% $CaCO_3$, 54% $MgCO_3$; meal, 100% thru 4 mesh; 20% thru 100 mesh	1.50
Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh	1.50
Mountville, Va.—Analysis, 62.54% $CaCO_3$; $MgCO_3$, 35.94%, 100% thru 20 mesh; 50% thru 100 mesh bags	5.50
Pixley, Mo.—Analysis, 96% $CaCO_3$; 50% thru 50 mesh	1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh	1.65
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@ 1.40
Stone City, Iowa.—Analysis, 98% $CaCO_3$; 50% thru 50 mesh	.75
Tulsa, Okla.—Analysis $CaCO_3$, 86.15%, 1.25% $MgCO_3$, all sizes	1.25

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk	3.00
Joliet, Ill.—Analysis, 48% $CaCO_3$; 42% $MgCO_3$; 90% thru 200 mesh; (for mine dusting and asphalt filler)	3.50
Piqua, Ohio, sacks, 4.50@5.00 bulk	3.00@ 3.50
Rocky Point, Va.—82% thru 200 mesh, 2.50@3.50 bulk, paper bags	3.75@ 4.75
Waukesha, Wis.—90% thru 100 mesh, bulk	4.50

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Berkeley Springs, W. Va.	2.00@ 2.25
Buffalo, N. Y.	2.00@ 2.50
Cedarville and S. Vineland, N. J.—Damp	1.75
Dry	2.25
Columbus, Ohio	1.00@ 1.50
Estill Springs and Sewanee, Tenn.	1.50
Gray Summit and Klondike, Mo.	1.75@ 2.00
Los Angeles, Calif.—Washed	5.00
Mapleton Depot, Penn.	2.00@ 2.25
Massillon, Ohio	3.00
Mendota, Va.	2.25@ 2.50
Mineral Ridge and Ohlton, Ohio	2.50
Oceanside, Calif.	3.00
Ottawa, Ill.	.75@ 1.25
Pittsburgh, Penn.	3.00@ 4.00
Ridgway, Penn.	2.50
Rockwood, Mich.	2.75@ 3.25
Round Top, Md.	2.00
San Francisco, Calif.	4.00@ 5.00
Silica, Va.	2.25@ 2.50
St. Louis, Mo.	2.00
Sewanee, Tenn.	1.50
Thayers, Penn.	2.50
Utica, Ill.	.90

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio		1.75
Columbus, Ohio		.30@ 1.50
Dresden, Ohio		1.25
Eau Claire, Wis.	4.25	.65@ 1.25
Estill Springs and Sewanee, Tenn.	1.35@ 1.50	1.35@ 1.50

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Ambridge & So. H'g'ts, Penn.	1.25	1.25	1.15	.85	.85	.85
Attica and Franklinville, N. Y.	.75	.75	.75	.75	.75	.75
Boston, Mass.‡	1.40	1.40			2.25	2.25
Erie, Pa.		1.00*		1.50*	1.75*	
Farmingdale, N. J.		.48	.75	1.20	1.10	
Hartford, Conn.	.65*					
Leeds Junction, Me.		.50	1.75		1.35	1.25
Machias Jct., N. Y.	.75	.75	.85	.75	.75	.75
Montoursville, Penn.		1.00	1.00	.90	.90	.90
Portland, Me.		1.00	2.25		2.00	
Shining Point, Penn.			1.00	1.00	1.00	1.00
Somerset, Penn.		2.00				
South Heights, Penn.	1.25	1.25	.85	.85	.85	.85
Washington, D. C.	.85	.85	1.70	1.50	1.30	1.30
York, Penn.	1.10	1.00				
CENTRAL:						
Algonquin and Beloit, Wis.	.50	.40	.60	.60	.60	.60
Appleton and Mankato, Minn.		.45	1.25	1.25	1.25	1.25
Attica, Ind.	All sizes .75@.85					
Aurora, Oregon, Sheridan, Moronts, Yorkville, Ill.	.60	.50	.40	.50	.60	.55
Barton, Wis. (f)		.50		.75	.75	.75
Chicago district, Ill.	.70	.55	.55	.60	.60	.60
Columbus, Ohio		.70	.70	.70	.70	
Des Moines, Ia.		.30	1.40	1.40	1.50	1.50
Eau Claire, Wis.	.65@1.25	.45	.80	.95	.95	
Elkhart Lake, Wis.	.60	.60	.70	.70	.70	.60
Ferrysburg, Mich.		.50@ .80	.60@1.00	.60@1.00		.50@1.25
Ft. Dodge, Iowa	.85	.85	2.05	2.05	2.05	2.05
Grand Haven, Mich.		.60@ .70		.70@ .90		.70@ .90
Grand Rapids, Mich.	.50	.50		.80	.70	.70
Hamilton, Ohio	.80@1.00	.80@1.00	.80@1.00		.80@1.00	.80@1.00
Hersey, Mich.		.50				.70
Humboldt, Iowa	.50	.50	1.50	1.50	1.50	1.50
Indianapolis, Ind.	.60	.60		.90	.75@1.00	.75@1.00
Joliet, Plainfield and Hammond, Ill.	.60	.50	.50	.60	.60	.60
Mason City, Iowa	.50	.50	1.45	1.45	1.35	1.35
Mankato, Minn.		.45	1.25	1.25	1.25	1.25
Mattoon, Ill.	.75@ .85	.60@ .85	.85	.85	.85	.85
Milwaukee, Wis.		1.01	1.21	1.21	1.21	1.21
Moline, Ill.	.60@ .85	.60@ .85	1.00@1.20	1.00@1.20	1.00@1.20	1.00@1.20
Northern New Jersey	.40@ .60	.40@ .60	1.25	1.25	1.25	1.25
Pittsburgh, Penn.	1.25	1.25	.85	.85	.85	.85
Silverwood, Ind.	.75	.75	.75	.75	.75	.75
St. Louis, Mo.	.83	1.45	1.55a	1.45	1.45	1.45
Terre Haute, Ind.	.75	.75	.75	.75	.75	.75
Wolcottville, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.		.45	.60	.60		.65
Winona, Minn.	.40	.40	1.50	1.25	1.25	1.15
Zanesville, Ohio		.60	.50	.60	.80	
SOUTHERN:						
Charleston, W. Va. (b)	All sand, 1.40. All gravel, 1.40					
Brewster, Fla.	.60	.60	2.25g			
Chattahoochie River, Fla.		.70		1.75		
Eustis, Fla.		.60@ .70				
Ft. Worth, Texas	2.00	2.00	2.00	2.00	2.00	2.00
Knoxville, Tenn.	1.25	1.25		1.20	1.20	1.20
Lindsay, Texas					.55	
Macon, Ga.		.50		.90	.90	
New Martinsville, W. Va.	1.00	.90@1.00		1.20@1.30		.80@ .90
Roseland, La.	.50	.50	2.25	1.25	1.00	1.00
WESTERN:						
Kansas City, Mo.		.70				
Los Angeles, Calif. (d)	.50	.50	1.10	1.10		1.10c
Oregon City, Ore.		1.50*	1.50*	1.50*	1.50*	1.50*
Phoenix, Ariz.	1.25*	1.25*	2.50*	2.00*	1.50*	1.25*
Pueblo, Colo.	.75	.60		1.15		1.20
San Diego, Calif.	.65@ .75	.65@ .75	1.50	1.30	1.10	1.10
Seattle, Wash. (bunkers)	1.25*	1.25*	1.25*	1.25*	1.25*	1.25*

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.	Dust to 3 in., .40					
Chicago district, Ill.	.35					
Ferrysburg, Mich.						.65@1.00
East Hartford, Ohio	.75*					
Gainesville, Texas						.55
Grand Rapids, Mich.				.55		
Hamilton, Ohio					.55@ .65	
Hersey, Mich.				.50		
Indianapolis, Ind.	Mixed gravel for concrete work, at .65					
Joliet, Plainfield and Hammond, Ill.	.35	1.25				
Macon, Ga.	.40					
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Ottawa, Oregon, Moronts and Yorkville, Ill.	Ave. .60 per ton all sizes					
Roseland, La.					.65	
Somerset, Penn.		1.85@2.00		1.50@1.75		
St. Louis, Mo.	Mine run gravel, 1.55 per ton					
Summit Grove, Ind.	.50	.50	.50	.50	.50	.54
Winona, Minn.	.40	.40	.60	.60	.60	.60
York, Penn.	1.10	1.00				

(a) ⅝ in. down. (b) River run. (c) 2½ in. and less.
*Cubic yd. †Include freight and bunkerage charges and truck haul. ‡Delivered on job by truck.
(d) Less 10c per ton if paid E.O.M. 10 days. (e) pit run. (f) plus 15c winter loading charge.
(g) ¾-in. and less.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Aetna, Ill.	....	....	....	.30@ .35	....	....	....
Albany, N. Y.	3.00	2.75	3.00	1.75	....	4.50	....
Arenzville, Ill.	1.50@1.75	....	....	1.00	....	....	....
Beach City, Ohio	1.75@2.25	1.75@2.25	....	1.75	2.00@2.50	....	1.75@2.00
Buffalo, N. Y.	1.50	1.50	....	2.00@2.50	....	....	....
Columbus, Ohio	1.25@2.00	1.25@1.75	2.00@2.50	.30@1.50	2.00@2.50	2.75@3.50	1.50@3.00
Dresden, Ohio	1.50@1.75	1.50	1.75	1.25	....	....	....
Eau Claire, Wis.	....	....	....	....	....	3.00	....
Elco, Ill.	Ground silica per ton in carloads—18.00@31.00						
Elnora, N. Y.	....	....	1.75	....	....	....	....
Estill Springs and Sewanee, Tenn.	1.25	....	....	1.25	....	1.35@1.50	....
Franklin, Penn.	1.75	1.75	....	2.00	....	....	....
Klondike, Mo.	1.75@2.00	....	1.75@2.00	1.75@2.00	1.75@2.00	....	1.75
Mapleton Depot, Pa.	2.25	2.00	....	2.00	....	....	....
Massillon, Ohio	2.25	2.25	....	2.50	2.50	....	....
Mendota, Va.	Ground flint or silex—16.00@20.00 per ton						
Michigan City, Ind.	....	....	....	.30	.30	....	....
Millville, N. J.	....	....	....	1.75b	....	3.50	....
Montoursville, Penn.	....	....	....	1.35@1.50	....	....	....
New Lexington, O.	2.75	2.25	....	....	....	....	....
Ohlton, Ohio	1.80b	1.80b	....	2.00b	1.75b	1.75b	....
Ottawa, Ill.	....	....	2.50	1.25	.75	3.50	3.00
Ridgeway, Penn.	1.50	1.50	....	....	....	....	....
Round Top, Md.	1.25	....	....	1.60	....	2.25	....
San Francisco, Calif.	3.50	4.75	3.50	3.50@5.00	3.50@4.50	3.50@5.00	....
Silica, Va.	....	....	....	10.00@16.00	....	....	....
Thayers, Penn.	1.25	1.25	....	2.00	....	....	....
Utica, Ill.	.50@1.00	.50@1.00	.50@1.00	.55@ .90	.60@1.00	3.00@3.25	.90@3.25
Utica, Ill.	.65	.70	....	.75	.90	....	....
Utica, Penn.	1.75	1.75	....	2.00	....	....	....
Warwick, Ohio	*1.75@2.25	*1.75@2.25	*1.75	*1.75@2.25	*1.75@2.25	....	....
Zanesville, Ohio	2.00‡	1.50‡	2.00‡	2.00	2.00	....	....

*Green. †Crude silica, crushed and screened, not washed or dried. ‡Plus 75c per ton for winter loading. ¶Crude. §Crude and dry. (a) Delivered. (b) Damp.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Emporium, Erie and Dubois, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern N. J.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Reading, Pa.	2.50	1.75	....	1.50	....	....	....
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05*	1.30*	1.75*	1.45*	1.30*	1.45*	1.45*
Jackson, Ohio	....	1.05*	....	1.30*	1.05*	1.30*	1.30*
Toledo, Ohio	1.50	1.25	1.25	1.25	1.25	1.25	1.25
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.	....	1.55*	....	1.55*	1.55*	1.55*	1.55*
Ensley and Alabama City, Ala.	2.05	.80	1.35	1.25	.90	.90	.80
Longdale, Roanoke, Ruessens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward, Ala.	2.05*	.80*	1.35*	1.25*	.90*	.90*	....

*5c per ton discount on terms.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime Blk.	Ground burnt lime Bags	Lump lime Blk.	Lump lime Bbl.
EASTERN:								
Berkeley, R. I.	....	....	12.00	....	....	....	....	2.15e
Buffalo, N. Y.	....	12.00	12.00	12.00	....	....	10.00	1.95d
Chazy, N. Y.	....	8.50	7.50	10.00	....	15.50$_{9}$	8.50	14.00
Lime Ridge, Penn.	....	....	....	....	5.00a	....	....	....
West Stockbridge, Mass.	12.00	10.00	5.60	....	....	....	....	2.00t
Williamsport, Penn.	....	....	10.00	....	....	....	6.00	....
York, Penn.	....	9.50	9.50	10.50	8.50	10.50	8.50	1.65i
CENTRAL:								
Afton, Mich.	....	....	....	....	....	....	8.50	1.35
Carey, Ohio	12.50	8.50	8.00	....	9.00	....	8.00	2.00
Cold Springs, Ohio	....	8.50	8.50	....	....	....	8.00	....
Delaware, Ohio	....	8.50	8.50	9.50	8.25$_{7}$	14.03$_{7}$	7.50	1.50c
Frederick, Md.	....	10.00	10.00	10.00	8.50	10.00	7.00	....
Gibsonburg, Ohio	12.50	8.50	8.50	....	9.00	11.00	8.00	....
Huntington, Ind.	12.50	8.50	8.50	....	9.00	....	8.00	....
Luckey, Ohio	12.50	....	....	....	....	....	....	....
Marblehead, Ohio	....	8.50	8.50	....	9.00	....	8.00	1.50w
Marion, Ohio	....	8.50	.850	....	....	....	8.00	1.70d
Milltown, Ind.	....	9.00@10.00	....	10.00p	....	....	8.50q	1.40r
Sheboygan, Wis.	11.50	....	....	....	9.50	....	9.50	....
White Rock, Ohio	12.50	....	....	....	9.00	11.00	8.00	....
Wisconsin points (f)	....	11.50	....	....	....	....	9.50	....
Woodville, Ohio	12.50	8.50	8.50	13.50$_{8}$	....	....	8.00	1.50c
SOUTHERN:								
Allgood, Ala.	12.50	10.00	....	....	8.50	....	8.50	1.50
El Paso, Texas	....	....	....	....	....	....	8.50	1.50
Graystone, Ala.	12.50	10.00	....	....	....	....	8.50	1.50
Keystone, Ala.	....	10.00	10.00	10.00	8.50	....	....	1.50
Knoxville, Tenn.	20.00	10.00	9.00	9.00	8.50	1.35	8.00	1.50
Longview, Ala.	12.50	10.00	9.00	10.00	....	....	8.50	1.50
New Braunfels, Tex.	18.00	12.00	10.00	12.00	10.00	....	9.50	....
Ocala, Fla.	14.00	13.00	12.00	13.00	....	....	12.00	1.70
Saginaw, Ala.	12.50	10.00	9.00	10.00	....	....	8.50	1.50
WESTERN:								
Kirtland, N. M.	....	....	....	....	....	....	15.00	....
Limestone, Wash.	15.00	15.00	10.00	15.00	16.50	16.50	16.50	2.09
Dittlinger, Tex.	....	12.00@13.00	....	....	....	....	9.50p	1.50$_{4}$
San Francisco, Calif.	21.00	19.00	16.50	....	....	....	14.00	2.00
Tehachapi, Calif.	....	....	8.00	....	....	....	13.00z	2.20x
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00	....	18.60	2.30

†50-lb. paper bags; (a) run of kilns; (c) wooden, steel 1.70; (d) steel; (e) per 180-lb. barrel; (f) dealers' prices, net 30 days less 25c disc. per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days; (i) 180-lb. net barrel, 1.65; 280-lb. net barrel, 2.65; (p) to 11.00; (q) to 8.75; (r) to 1.50; (s) in 80-lb. burlap sacks; (t) to 3.00; (u) two 90-lb. bags; (v) oil burnt; wood burnt 2.25@2.50; (x) wood. steel 2.30; (z) to 15.00; (*) quoted f.o.b. New York; (‡) paper bags; (w) to 1.50 in two 90-lb. bags, wood bbl. 1.60; (¶) to 10.00; ($_{1}$) 80-lb. paper bags; ($_{2}$) to 3.00; ($_{3}$) to 9.00; ($_{4}$) to 1.60. ($_{5}$) to 16.00; ($_{6}$) wood bbl., steel, 1.80; ($_{7}$) quoted f.o.b. Marble Cliff, Ohio; ($_{8}$) superfine; ($_{9}$) barrels.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing sand	Traction
Mapleton Depot, Penn.	2.00	2.00@ 2.25
Massillon, Ohio	....	2.25
Michigan City, Ind. (Engine sand)	....	.15@ .25
Mineral Ridge, Ohio	*1.75@ 2.00	*1.75
Montoursville, Penn.	....	1.00@ 1.10
Ohlton, Ohio	1.80	1.80
Ottawa, Ill.	1.25	1.25
Red Wing, Minn.	....	1.25
Round Top, Md.	2.25	1.75
San Francisco, Calif.	3.50@ 4.50	3.50@ 4.50
Thayers, Penn.	....	2.25
Utica, Ill.	.90@ 3.25	.90
Warwick, Ohio	....	2.25
Zanesville, Ohio	....	2.50

*Wet.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point,

Baltimore, Md.:	
Crude talc (mine run)	3.00@ 4.00
Ground talc (20-50 mesh), bags	10.00
Cubes	55.00
Blanks (per lb.)	.08
Pencils and steel worker's crayons	.08
per gross	1.00@ 1.50
Chatsworth, Ga.:	
Crude Talc	5.00
Ground (150-200 mesh), bulk	10.00
Pencils and steel worker's crayons, per gross	1.00@ 2.00
Chester, Vt.:	
Crude talc	3.50@ 4.00
Ground talc (150-200 mesh), bulk	8.00@ 9.00
Including bags	9.00@10.00
Chicago and Joliet, Ill.:	
Ground (150-200 mesh), bags	30.00
Dalton, Ga.:	
Crude talc	5.00
Ground talc (150-200) bags	10.00@12.00
Pencils and steel workers' crayons, per gross	1.00@ 1.50
Emeryville, N. Y.:	
(Double air floated) including bags; 325 mesh	14.75
200 mesh	13.75
Hailesboro, N. Y.:	
Ground white talc (double and triple air floated) including bags, 300-350 mesh	15.50@20.00
Henry, Va.:	
Crude (mine run)	3.50@ 4.00
Ground talc (150-200 mesh), bulk	7.75@14.00
Joliet, Ill.:	
Roofing talc, bags	12.00
Ground talc (200 mesh), bags	30.00
Keeler, Calif.:	
Ground (200-300 mesh), bags	20.00@30.00
Natural Bridge, N. Y.:	
Ground talc (125-200 mesh), bags	10.00@15.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 68-72%	3,75@ 4.25
Mt. Pleasant, Tenn.—B.P.L. 75%	5.50@ 6.00
Tennessee—F.O.B. mines, gross ton, unground brown rock, B.P.L. 72%	5.00
B.P.L. 75%	6.00
Twomey, Tenn.—B.P.L. 65%, 2000 lb.	8.00@ 9.00

Ground Rock

(2000 lbs.)

Centerville, Tenn.—B.P.L. 65%	7.00
Gordonsburg, Tenn.—B.P.L. 68-72%	4.00@ 5.00
Mt. Pleasant, Tenn.—B.P.L. 65%	*8.00
Twomey, Tenn.—B.P.L. 65%	8.00@ 9.00

*With premium of 20c per ton for each 1% over 65%, and corresponding deduction, if any.

Florida Phosphate

(Raw Land Pebble)

(Per Ton.)

Florida—F. O. B. mines, gross ton, 68/66% B.P.L., Basis 68%	3.25
70% min. B.P.L., Basis 70%	3.75

Mica

Prices given are net, F.O.B. plant or nearest shipping point.

Pringle, S. D.—Mine run, per ton	125.00
Punch mica, per lb.	.06
Scrap, per ton, carloads	20.00
Rumney Depot, N. H.—per ton,	
Mine run	360.00
Clean shop scrap	24.00
Mine scrap	20.00
20 mesh	30.00
60 mesh	37.00
100 mesh	45.00
Roofing mica	35.00
Punch mica, per lb.	.12

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Barton, Wis., f.o.b. cars		10.50
Brandon, Vt.—English pink, English cream and coral pink	*11.00	*11.00
Brandon grey	*11.00	*11.00
Brighton, Tenn.—Pink	6.00	5.00
Mixed pink and bronze	4.50@ 6.00	4.50@ 6.00
All colors, mixed sizes	3.50	3.50
Buckingham, Que.—Buff stucco dash		12.00@14.00
Chicago, Ill. — Stucco chips, in sacks f.o.b. quarries		17.50
Crown Point, N. Y.—Mica spar		9.00@10.00
Dayton, Ohio		6.00@24.00
Easton, Penn., and Phillipsburg, N. J.		12.00@20.00
Haddam, Conn. — Felstone buff	15.00	15.00
Harrisonburg, Va.—Bulk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio — Concrete facings and stucco dash		6.00@16.00
Middlebrook, Mo.—Red		20.00@25.00
Middlebury, Vt.—Middlebury white	‡9.00	‡9.00
Middlebury and Brandon, Vt.—Caststone, per ton, including bags		5.50
Milwaukee, Wis.		14.00@34.00
Newark, N. J.—Roofing granules		7.50
New York, N. Y.—Red and yellow Verona		32.00
Red Granite, Wis.		7.50
Stockton, Calif. — "Natrock" roofing grits		12.00@15.00
Tuckahoe, N. Y.—Tuckahoe white	12.00	
Wauwatosa, Wis.		20.00@32.00
Wellsville, Colo.—Colorado Travertine Stone	15.00	15.00

†C.L. L.C.L. 17.00.
*C.L. including bags; L.C.L. 14.50
‡C.L. including bags, L.C.L. 10.00.

Potash Feldspar

Auburn and Brunswick, Me.—Color, white; 98% thru 140 mesh bulk	19.00
Buckingham, Que.—Color, white; analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk	9.00
De Kalb Jct., N. Y.—Color, white; bulk (crude)	9.00
East Hartford, Conn.—Color, white, 95% through 60 mesh, bags	16.00
96% thru 150 mesh, bags	30.00
East Liverpool, Ohio—Color, white; 98% thru 200 mesh, bulk	19.35
Soda feldspar, crude, bulk, per ton	22.00
Erwin, Tenn.—Color, white; analysis, 12.07% K_2O, 19.34% Al_2O_3; Na_2O, 2.92%; SiO_2, 64.76%; Fe_2O_3, .36%; 98.50% thru 200 mesh, bags, 16.90; bulk	15.50
Glen Tay Station, Ont., color, red or pink; analysis: K_2O, 12.81%, crude (bulk)	7.00
Keystone, S. D.—Prime white, bulk (crude)	8.00
Los Angeles, Calif. — Color, white; analysis, K_2O, 12.16; Na_2O, 1.53; SiO_2, 65.60; Fe_2O_3, .10; Al_2O_3, 19.20; crude	10.00
Pulverized, 95% thru 200 mesh; bags, 22.00; bulk	20.00
For glass manufacturers — (F. o. b. C.L., sacks included): Grade A: Analysis, Al_2O_3, 19.20; Fe_2O_3, .10—	20.48
Grade B: Analysis, Al_2O_3, 18.94; Fe_2O_3, .10	18.33
Murphysboro, Ill.—Color, prime white; analysis, K_2O, 12.60%; Na_2O, 2.35%; SiO_2, 63%; Fe_2O_3, .06%; Al_2O_3, 18.20%; 98% thru 200 mesh; bags, 21.00; bulk	20.00
Penland, N. C.—Color, white; crude, bulk	8.00
Ground, bulk	16.50
Spruce Point, N. C., and Bristol, Tenn.—Color, white; 90% thru 200 mesh, bulk	12.50@20.00
Tenn. Mills—Color, white; analysis K_2O, 18%; Na_2O, 10%; 68% SiO_2; 99% thru 200 mesh; bulk	18.00
99% thru 140 mesh, bulk	16.00
Topsham, Me.—98% thru 140 mesh, bulk	19.00
Toronto, Can.—Color, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude	7.50@ 8.00

Chicken Grits

Afton Mich. (limestone) per ton	10.00
Belfast and Rockland, Me.—(Limestone), bags, per ton	‡10.00
Brandon and Middlebury, Vt., per ton	10.00
Cartersville, Ga.—(Limestone), per bag	2.00
Centerville, Iowa (gypsum) per ton	18.00
Chico, Texas (limestone), 100 lb. bags, per ton	8.00@ 9.00
Danbury, Conn. (limestone), bulk	6.00@ 7.00
Easton, Penn.—Per ton, bulk	3.00
Joliet, Ill.—(Limestone), bags, per ton	4.50
Knoxville, Tenn.—per bag	1.25
Los Angeles, Calif. (feldspar) per ton	15.00
Gypsum, Ohio.—(Gypsum) per ton	10.00
Limestone, Wash. (limestone) per ton	12.50
Rocky Point, Va. (limestone) 100 lb. bags, 50c; sacks, per ton, 6.00 bulk	5.00
Seattle, Wash.—(Limestone), bulk, per ton	12.00
Warren, N. H.—(Mica) per ton	3.85@ 3.90
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.—(Limestone) bulk	7.50@9.00*
Wisconsin Points (limestone) per ton	9.00

*L.C.L. †Less than 5-ton lots. ‡C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted

Anaheim, Calif.	10.50@11.00
Barton, Wis.	10.50@13.00b
Boston, Mass.	*17.00
Brighton, N. Y.	*19.75
Dayton, Ohio	12.00@13.50
Detroit, Mich.	*17.50
Farmington, Conn	13.00
Grand Rapids, Mich	12.00
Hartford, Conn.	*19.00
Jackson, Mich.	12.25
Lakeland, Fla.	10.00@11.00
Lake Helen, Fla.	10.00@15.00
Lancaster, N. Y.	12.50
Madison, Wis.	a12.50
Michigan City, Ind.	11.00
Milwaukee, Wis.	*13.00
Minneapolis and St. Paul, Minn.	13.00
Minnesota Transfer	10.00
New Brighton, Minn.	10.00
Pontiac, Mich.	12.00@13.50
Portage, Wis.	15.00
Prairie du Chien, Wis.	18.00@22.50
Rochester, N. Y.	*19.75
Saginaw, Mich.	13.00
San Antonio, Texas	16.00
Sebewaing, Mich.	12.00
Sioux Falls, S. Dak.	13.00c
Syracuse, N. Y.	18.00@20.00*
Toronto, Canada	15.00
Toronto, Canada	12.60
Wilkinson, Fla.	10.00@12.00
Winnipeg, Canada	*15.00

*Delivered on job. †Delivered in city.
‡Less 5%. ¶Dealers' price. (a) Less .50 E.O.M. 10 days. (b) Delivered to Milwaukee. (c) Delivered at yard.

Portland Cement

Prices per bag and per bbl, without bags net in carload lots.

	Per Bag	Per Bbl.
Albuquerque, N. M.	.86¾	3.47
Atlanta, Ga.		2.35
Baltimore, Md.		2.25
Birmingham, Ala.	. .	2.30
Boston, Mass.	.63¼	2.53
Buffalo, N. Y.	.59½	2.38
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa		2.24‡
Charleston, S. C.		2.35
Cheyenne, Wyo.	.82¾	3.31
Cincinnati, Ohio		2.32
Cleveland, Ohio		2.24
Chicago, Ill.		2.05
Columbus, Ohio		2.34
Dallas, Texas		2.10
Davenport, Iowa		2.24
Dayton, Ohio		2.38
Denver, Colo.	.66¼	2.65
Detroit, Mich.		2.15
Duluth, Minn.		2.04
Houston, Texas		2.60
Indianapolis, Ind.		2.19
Jackson, Miss.		2.60
Jacksonville, Fla.		2.20
Jersey City, N. J.		2.23
Kansas City, Mo.		1.92
Los Angeles, Calif.	.60@.64†	
Louisville, Ky.	.54½	
Memphis, Tenn.		2.60
Milwaukee, Wis.		2.20
Minneapolis, Minn.		2.22‡
Montreal, Que.		1.36
New Orleans, La.		2.20
New York, N. Y.	.53¾	2.15
Norfolk, Va.		2.17
Oklahoma City, Okla.		2.46
Omaha, Neb.		2.36
Peoria, Ill.		2.22
Philadelphia, Penn.		2.31
Phoenix, Ariz.	.81½	3.26
Pittsburgh, Penn.		2.04
Portland, Colo.		2.80
Portland, Ore.		2.60
Reno, Nevada		2.91
Richmond, Va.		2.44
Salt Lake City, Utah	.70¼	2.81
San Francisco, Calif.		2.21
Savannah, Ga.		2.50
St. Louis, Mo.		2.05
St. Paul, Minn.		2.22‡
Seattle, Wash.		2.50*
Tampa, Fla.		2.25
Toledo, Ohio		2.20‡
Topeka, Kans.		2.41
Tulsa, Okla.		2.33
Wheeling, W. Va.		2.17
Winston-Salem, N. C.		2.78

NOTE—Add 40c per bbl. for bags.

†Delivered on job in any quantity, sacks extra.

‡Ten cents discount for cash, 15 days.

*Ten cents discount for cash, 10 days. (a) Price includes sacks.

Mill prices f.o.b. in carload lots, without bags to contractors.

	Per Bag	Per Bbl
Buffington, Ind.		1.80
Chattanooga, Tenn.		2.45*
Concrete, Wash.		2.35
Davenport, Calif.		2.05
Detroit, Mich.		2.15
Hannibal, Mo.		1.85
Hudson, N. Y.		1.95
Leeds, Ala.		1.95
Mildred, Kans.		2.35
Nazareth, Penn.		1.95
Northampton, Penn.		1.85
Richard City, Tenn.		2.05
Steelton, Minn.		1.85
Toledo, Ohio		2.20
Universal, Penn.		1.80

*Including sacks at 10c each.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ¼x32x 36". Wt. 1500 lb. Per M Sq. Ft.	⅜x32x 36". Wt. 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48". Lgths. 6'-10', 1850 lb. Per M Sq. Ft.
Arden, Nev. and Los Angeles, Calif.	3.00	8.00u	8.00u	10.70u	10.70u					11.70u			
Centerville, Iowa	3.00	10.00	15.00	10.00	10.00	10.50	13.50			13.50			
Des Moines, Ia.	3.00	8.00	9.00	10.00	10.00	10.50	13.50	12.00	24.00	22.00	18.00	21.00	30.00
Detroit, Mich.					14.30o	12.30m		m9.00@11.00o					
Delawanna, N. J.						8.00		8.25@9.40			.14⅕s	.15⅕s	40.00@41.0
Douglas, Ariz.			6.00				15.00		40.00	13.50	35.00	45.00	
Grand Rapids, Mich.	2.75	6.00	6.00	8.00	9.00	9.00	17.50		24.55	20.00			
Gypsum, Ohio	3.00	4.00	6.00	8.00	9.00	9.00	20.00	7.00	27.00	19.00		15.00	30.00
Los Angeles, Calif.			7.50y	11.50y									
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00		20.00	30.00
Portland, Colo.				10.00									
San Francisco, Calif.			11.65m	13.40r	14.40r		15.40r						
Seattle, Wash.	6.60	11.00	11.00	12.00	13.00								
Sigurd, Utah	.								21.50				
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00					20.00	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).

*To 3.00; †to 11.00; ‖to 12.00; ‡prices per net ton, sacks extra; (a) to 25.00; (b) net; (c) gross; (d) hair fibre; (f) delivered; (h) delivered in six states; (i) delivered on job; (k) sacks 12c extra, rebated; (m) includes paper bags; (o) includes jute sacks; (r) including sacks at 15c; (s) per board; (t) to 16.50; (u) includes sacks; (v) F.O.B. N. Y. C. and dealer's yard in mill locality; (x) Hardwall plaster; (y) sacks 15c extra, rebated.

Market Prices of Cement Products

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City of shipping point	8x8x16	8x10x16	8x12x16
Camden, N. J.	17.00		
Cement City, Mich.		5x8x12—55.00¶	
Columbus, Ohio	.16@.18a		
Detroit, Mich.	.16		.18
Forest Park, Ill.	18.00*	23.00*	30.00*
Grand Rapids, Mich.	12.00		
Graettinger, Iowa	.18@.20		
Indianapolis, Ind.	.13@.15†		
Los Angeles, Calif.¶	5¾x3½x12—55.00	7¾x3½x12—65.00	
Oak Park, Ill.	18.00@40.00¶		
Olivia and Mankato, Minn.	9.50b		
Somerset, Penn.	.20@.25		
Tiskilwa, Ill.	.16@.18†		
Yakima, Wash.	20.00*		

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡Delivered. ¶Price per 1000. (b) Per ton.

Cement Roofing Tile

Prices are net per sq. in carload lots, f.o.b. nearest shipping point unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.

Red	15.00
Green	18.00
Chicago, Ill.—per sq.	20.00

Cicero, Ill.—Hawthorne roofing tile, per sq.

	Chocolate, Red and Orange	Green Blue
French and Spanish†	$11.50	$13.50
Ridges (each)	.25	.35
Hips	.25	.35
Hip starters	.50	.60
Hip terminals, 2-way	1.25	1.50
Hip terminals, 4-way	4.00	5.00
Mansard terminals	2.50	3.00
Gable finials	1.25	1.50
Gable starters	.25	.35
Gable finishers	.25	.35
*End bands	.25	.35
*Eave closers	.06	.08
*Ridge closers	.05	.06

*Used only with Spanish tile.
†Price per square.

Houston, Texas.—Roofing Tile, per sq.	25.00
Indianapolis, Ind.—9x15-in.	Per sq.
Gray	10.00
Red	11.00
Green	13.00
Waco, Texas:	Per sq.
6:4	.60

Cement Building Tile

Cement City, Mich	Per 1000
5x8x12	55.00
Detroit, Mich.	Per 100
5x4x12	4.50
5x8x12	8.00
Longview, Wash.	Per 1000
4x6x12	52.00
4x8x12	64.00
Mt. Pleasant, N. Y.:	Per 1000
5x8x12	78.00
Grand Rapids, Mich.:	Per 100
5x8x12	7.00
Houston, Texas:	
5x8x12 (Lightweight)	80.00
Pasadena, Calif. (Stone-Tile)	Per 100
3½x4x12	3.00
3½x6x12	4.00
3½x8x12	5.50
Tiskilwa, Ill.—8x8, per 100	15.00
Wildasin Spur, Los Angeles, Calif. (Stone-Tile)	Per 1000
3½x6x12	50.00
3½x8x12	60.00
Prairie du Chien, Wis. 14.00	22.50@27.00
Yakima, Wash.—Building tile:	
5x8x12	.10

Cement Drain Tile

Graettinger, Iowa—5 to 36 in., per ton	8.00
Olivia and Mankato, Minn.—Cement drain tile, per ton	8.00
Tacoma, Wash.—Drain tile per ft.:	
3 in.	.04
4 in.	.05
6 in.	.07½
8 in.	.10
Waukesha, Wis.—Drain tile, per ton	8.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	25.00@40.00
Baltimore, Md. (Del. according to quantity)	15.50	22.00@50.00
Camden and Trenton, N. J.	17.00	
Ensley, Ala. ("Slag-tex")	14.50	22.50@33.50
Eugene, Ore.	25.00	35.00@75.00
Friesland, Wis.	22.00	32.00
Longview, Wash.	18.00	25.00@75.00
Milwaukee, Wis.	15.00	25.00@75.00
Mt. Pleasant, N. Y.		14.00@23.00
Omaha, Neb.	18.00	30.00@40.00
Pasadena, Calif.	10.00	
Philadelphia, Penn.	15.00	20.00
Portland, Ore.	17.50@21.00	25.00@55.00
Mantel brick—100.00@150.00		
Prairie du Chien, Wis.	14.00	23.00
Rapid City, S. D.	18.00	25.00@80.00
Waco, Texas	16.50	32.50@125.00
Watertown, N. Y.	20.00	35.00
Westmoreland Wharves, Penn.	15.00	20.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	

†Gray. ‡Red.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted.

Culvert and Sewer	4 in.	6 in.	8 in.	10 in.	12 in.	15 in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.								15.00 per ton									
Graettinger, Iowa	.04½d	.05½	.08½	.12½	.17½	—	.40	.50	.60	.70	—	—	—	—	—	—	—
G'd Rapids, Mich. (b)																	
Culvert pipe	—	—	—	.60	.72	1.00	1.28	1.60†	—	1.92	2.32	3.00	4.00	5.00	6.00	—	—
Sewer pipe	.11	.15	.25	.29	.38	.59	1.00	1.26†	—	1.89	—	—	—	—	—	—	—
Houston, Texas	—	.19	.28	.43	.55½	.90	1.30	—	†1.70	2.20	—	—	—	—	—	—	—
Indianapolis, Ind. (a)	—	—	—	.80	.90	1.10	1.30	—	—	1.70	—	2.70	—	—	—	—	—
Longview, Wash.							Sewer pipe 40% off list, culvert—list										
Mankato, Minn. (b)	—	—	—	—	—	—	—	—	—	1.50	1.75	2.50	3.25	4.25	—	—	—
Newark, N. J.						6 in. to 24 in., $18.00 per ton											
Norfolk, Neb. (b)	—	—	—	.90	1.00	1.13	1.42	—	—	2.11	—	2.75	3.58	—	6.14	—	7.78
Olivia, Mankato, Minn.							12.00 per ton										
Paullina, Iowa‡	—	—	—	—	—	—	—	2.25	—	2.11	—	2.75	3.58	—	6.14	—	7.78
Somerset, Penn.	—	—	—	—	1.08	1.25	1.65	—	—	2.50	—	3.65	4.85	7.50	8.50	—	—
Tacoma, Wash.	.15	.18	.22½	.30	.40	.55	.75	—	—	—	—	—	—	—	—	—	—
Tiskilwa, Ill. (rein.) (a)	—	—	—	.65	.75	.85	1.10	1.60	—	1.90	—	2.25	3.40	—	5.50	—	—
Wahoo, Neb. (b)	—	—	—	—	1.00	1.13	1.42	—	—	2.11	—	2.75	3.58	4.62	6.14	6.96	7.78
Yakima, Wash.									$10.00 per ton								

*30-in. lengths up to 27-in. diam., 48-in. lengths after; (a) 24-in. lengths; (b) Reinforced; (c) Interlocking bar reinforced.
†21-in. diam. ‡Price per 2 ft. length. (d) 5 in. diam. [1]@1.08 [2]@1.25. [3]@1.65. [4]@2.50. [5]@3.85. [6]@5.00. [7]@7.50.

Portland Bids on Sand and Gravel

BIDS were opened recently by the Multnomah county, Ore., commissioners on sand and gravel for the county road department. Bids were as follows:

Portland Sand and Gravel Co., 3500 cu. yd. crushed gravel, 50c per cu. yd.; 2000 cu. yd. washed bank pea gravel, 70c per cu. yd.

I. L. Davidson, 2000 cu. yd. gravel, 75c per cu. yd. f.o.b. trucks or 50c per cu. yd. in pit at Troutdale.

Pacific Bridge Co., 500 cu. yd., more or less, coarse concrete sand, f.o.b. cars at bunkers, 66c yd.; f.o.b. trucks at bunkers, 60c yd.—*Portland (Ore.) Journal of Commerce.*

Indiana Gravel Contracts

CONTRACTS for supplying gravel to Posey county, Indiana, were awarded to the Koch Sand and Gravel Co., Mt. Vernon, Ind.; Bedford-Nugent Co., Evansville, and the McGrath Sand and Gravel Co. of Shawneetown. Contracts called for gravel placed on the bank at numerous points on the Ohio and Wabash rivers, and ranged in price from $1.10 per cu. yd. at Mt. Vernon to $2.03 at Carborn, Ford and St. Phillips.—*Evansville (Ind.) Courier.*

Los Angeles Company Buys Sandstone Quarry

THE Bly Stone Co. of Los Angeles, Calif., recently purchased the Refugio Sandstone Quarry located in Refugio Canyon, some 25 miles north of Santa Barbara on the coast highway of California, advises Brinton Jones, secretary-treasurer. The quarry is a sheet formation of wide proportions, yielding a high grade sandstone, richly colored in the buffs, browns and yellow.

The quarry has already been opened, Mr. Jones states, and is supplying the sandstone for the new Hall of Records, court house and jail now being erected at Santa Barbara, for which the company holds the stone contract, approximating $75,000.

Oregon Portland Elects Officers

THE Oregon Portland Cement Co., which recently consolidated with the Sun Portland Cement Co. (ROCK PRODUCTS, January 8 issue), held their first meeting January 12 at which time the following officers were elected:

President, R. B. Butchart of Victoria, B. C.; vice-presidents, L. C. Newlands of Portland and H. A. Ross of Victoria, formerly president of the Sun company; secretary and treasurer, H. L. Knappenberger.

L. C. Newlands will be general manager. The new board of directors is composed of the officers listed above and Edward Cookingham, vice-president of the United States National bank of Portland; Edward B. Ireland, manager of the Canadian Bank of Commerce. Chester V. Dolph was chosen attorney-in-fact and agent.

Mr. Newlands in his report stated that the new year had opened auspiciously and there were more large construction jobs planned for an early start than usual. To meet an expected large demand for cement this year there is on hand at Oswego about 90,000 bbl. of cement and clinker and at Lime about 110,000 llb. of cement and clinker. It was decided at this meeting that the Oregon Portland Cement Co. will be continued under the same style and titles as formerly.

Census of Cement Manufacture in 1925

THE Department of Commerce announces that, according to data collected at the biennial census of manufactures taken in 1926, the establishments in the United States which were engaged primarily in the manufacture of cement reported, for 1925, a total production valued at $300,895,070, an increase of 13.9% as compared with $264,098,497 for 1923, the last preceding census year. This total consisted of 161,658,901 bbl. of portland cement valued at $293,964,730, 1,729,343 bbl. of natural and puzzolan cement valued at $2,709,030, and miscellaneous products, such as ground stone and shale, paving dust, asphalt filler and clinkers, valued at $4,221,310.

Of the 145 establishments reporting for 1925, 6 were located in Alabama, 10 in California, 5 in Illinois, 5 in Iowa, 8 in Kansas, 16 in Michigan, 5 in Missouri, 10 in New York, 10 in Ohio, 22 in Pennsylvania, 6 in Texas, 4 in Washington, and the remaining 38 in 17 other states.

The figures for 1925, presented herewith, are preliminary and subject to such correction as may be found necessary upon further examination of the returns.

SUMMARY FOR THE CEMENT INDUSTRY FOR THE UNITED STATES: 1925 AND 1923

	1925	1923	Per cent of inc.
Number of establishments	145	133	9.0
Wage earners (average number)*	38,437	35,091	9.5
Maximum month	Sept. 40,826	Aug. 37,437	.....
Minimum month	Feb. 34,978	Jan. 31,114	.....
Per cent of maximum	85.7	83.1	.....
Wages†	$ 53,911,519	$ 49,707,992	8.5
Cost of materials (including fuel and mill supplies)†	‡$114,168,969	‡$100,766,747	13.3
Products, total value†	‡$300,895,070	‡$264,098,497	13.9
Portland cement:			
Barrels	161,658,907	137,460,238	17.6
Value	‡$293,964,730	‡$260,658,875	12.8
Natural and puzzolan cement:			
Barrels	1,729,343	1,325,465	30.5
Value	‡$2,709,030	‡$2,029,685	33.5
Products other than cement, value	$4,221,310	$1,409,937	199.4
Value added by manufacture§	$186,726,101	$163,331,750	14.3

*Not including salaried employes.

†The amount of manufacturers' profits cannot be calculated from the census figures, for the reason that no data are collected in regard to a number of items of expense, such as interest, rent, depreciation, taxes, insurance and advertising.

‡The value of containers is not included for 1923; for 1925, the cost of materials includes the cost of nonreturnable containers and net loss on returnable containers, and the value of cement includes the value of nonreturnable containers sold with the product, but not that of returnable containers.

§Value of products less cost of materials.

Colorado Portland Improves Plant

DURING 1926 the new machinery installed at the Portland, Colo., mill of the Colorado Portland Cement Co. was thoroughly "broken in" so as to properly speed it up to capacity production, E. J. Strock, superintendent of the mill, says in a recent item published in the Pueblo (Colo.) *Star-Journal*. The number of grinding units in use at the raw and finish ends was reduced from 28 to four large ones by the new installation. Dust collectors and other equipment were also added.

Comfort of the employes was not overlooked, and shower rooms, lavatories, etc., were installed at various places, both in the new and old buildings. In general a "dolling up" campaign was instituted which included concrete paving in and about the supply building and shops, painting of all of the older plant buildings, installation of a new concrete pump house at the river, together with a new concrete intake to replace the wooden affair.

At the quarries a number of large shots were set off during the year and a new shale face opened in the new quarry.

Two Cement Plants Finish Year Without a Single Accident

THREE hundred and fifty men at the Mitchell (Ind.) plant of the Lehigh Portland Cement Co. and 200 at the Winnipeg plant of the Canada Portland Cement Co., Ltd., went through the year 1926 without a single time-lost accident, according to W. M. Kinney, general manager of the Portland Cement Association.

By making this record, each plant will be awarded a concrete trophy which carries the thought, "Safety follows wisdom," and which is cast from a design created at the Art Institute of Chicago. These trophies will be presented to representatives of each plant at the spring meeting of the association. The representatives will be chosen by the workmen. After the formal presentation, the trophies will be erected in the yards of the winning plants.

An annual contest for this award which is sponsored by the Portland Cement Association is open to all plants operated by member companies. In 1926, 129 plants in the United States, Canada and South America were entered in it. The plant which has the best safety record of the year wins the award. As two plants had perfect records during 1926, each will receive a trophy.

Although complete figures are not yet available, preliminary data indicate that fewer accidents occurred in cement mills in 1926 than in 1925, which was the banner year up to that time. "In October of 1925, 253 time-lost accidents and nine fatalities were registered among the 40,000 workmen in cement mills," said Mr. Kinney. "In the same month of 1926 there were three fatalities and 143 time-lost accidents. This is a remarkable record, since October is the 'Jonah' month of the industry.

"The safety-first work of the Portland Cement Association since 1920 has reduced the number of cement mill accidents 50 per cent, although industrial accidents have increased in general during this period. When we first began this work 13 years ago, we found that responsibility for accidents lay about 25% with the manufacturers and 75% with the men.

"Investigators found that some of the machinery was dangerous, and that the men were frequently reckless. The manufacturers protected their machinery, and then we began an intensive campaign among the men.

"This work was begun for the benefit of their employes, but they soon found it to be a good dollars-and-cents investment, since it improved manufacturing personnel, reduced delays, and cut down accident compensation."

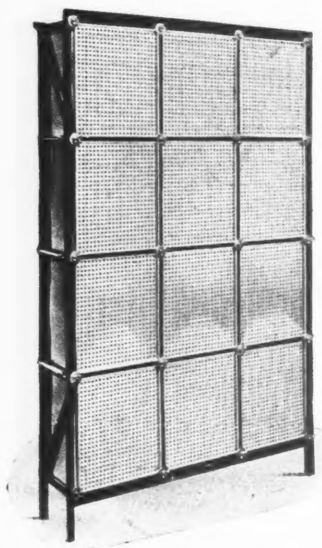
This is the second consecutive year in which two plants have been awarded trophies. The Port Colborne plant of the Canada Portland Cement Co. and the Duluth plant of the Universal Portland Cement Co. each went through the entire year of 1925 and through the first half of 1926 without a single time-lost accident.

New Machinery and Equipment

Air Filter and Dust Remover

THE American Blower Co., Detroit, Mich., have put on the market a dry plate air filter for the removal of dust from air entering gas and oil engines, pneumatic tools, air compressors, etc. It can, the company says, be adapted and used for the recovery and collection of industrial dusts.

The system consists of a metallic frame to receive the individual rectangular filter cells. The number of cells placed in the frame varies according to the capacity desired. Since each cell is an independent unit, the arrangement in banks or tiers can be adjusted to meet the installation area. The frames are assembled with the cells either horizontally or vertically and form an interlocked, self-supporting battery. Each cell slides into an individual frame pocket and is secured by a thumb screw lock



Typical battery of filter cell units, 3 cells wide and 4 cells high

which holds it against the dustproof seal back rim of the supporting sectional frame.

The filter cell is composed of 10 or more plates made of perforated aluminum arranged in series. A fireproof filament is placed on these plates and securely held into place. The outer edges of the plate are flanged to give strength and definite spacing between plates. The plates are put in place in a reinforced aluminum frame and held into position by eight small bolts. The total weight of the entire cell is given as 4½ lb.

The operation of the system is as follows: The entering dust laden air is divided into a series of small jets by the perforations in the first plate (see Fig. 1). These small jets of air strike the flat filament coated surface of the second plate, dusts and soots are projected against the filament and seized and retained, while the air, changing its direction and rebounding from the surface, flows parallel to the plate surface to the staggered orifice of the second plate, passing on through 10 successive dust removal operations identical to the above. As dust builds up on these flat surfaces, each preceding layer acts as a retentive member, the dust itself being the principal dust arresting and retaining factor for the ensuing particles.

The purified air passes through the orifies

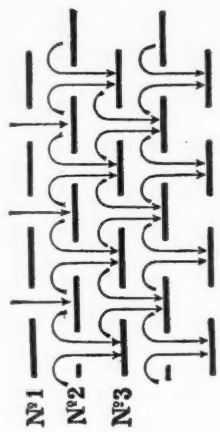
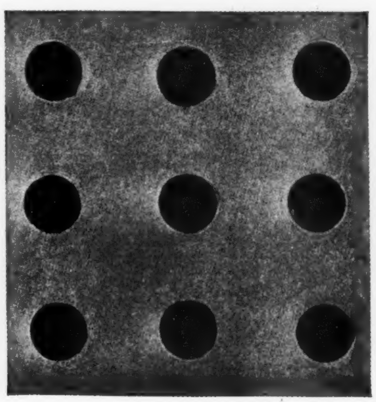
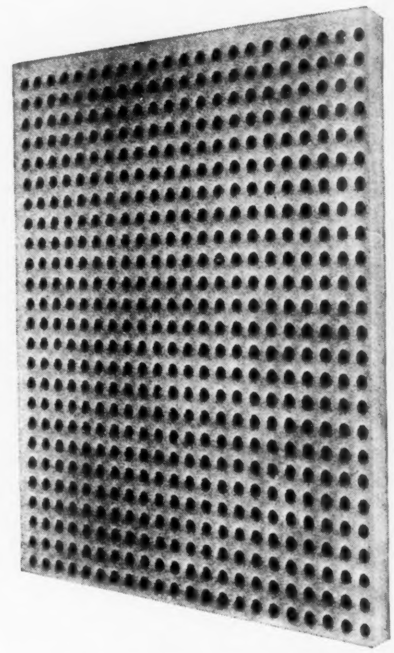


Fig. 1. Action of the filter showing the course of the air in passage through the cell

unobstructed by the dust particles, which are deposited on the intervening flat surfaces, thus giving, it is said, constant effectiveness and an unvarying flow of air, independent of the amount of dust load retained by the filter surface. The air is purified from plate to plate in a constantly decreasing rate of removal, proportional to the multiple effect of the plates. The cleansing effect inherent in each plate is best illustrated by the fact that with 10 plates, the last plate collects, it is said, approximately 1/100 by weight of the total dust as compared to dust collected by the first plate in the filter cell unit.

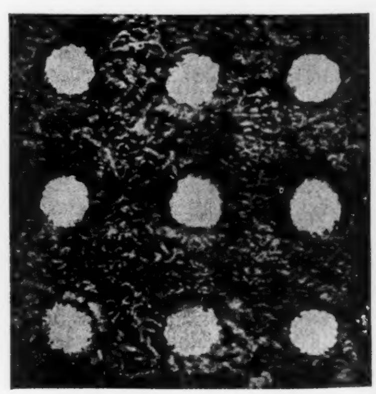


Portion of perforated plate before dust laden air is drawn through filter cell



One of the perforated plates making up a filter cell

Each cell, it is said, will retain from 2 to 2½ lb. of dirt and maintain its effectiveness. To unload, the operator removes the individual cell from the section, rests one edge on the floor and raps the opposite side with the open hand. Larger installations, particularly where industrial dusts are collected, can use a specially constructed unloading mechanical rapper. Temperatures as high as 175 deg. F. may be used in the standard filler cells. The efficiency of the system is dependent on the particular case of use, but the manufacturers state that a laboratory test shows a removal of 93% of the solids in air continuously until fully loaded, with no redistribution of dust to the air and with an unchanged flow of air volume.



Portion of plate after using showing the dust collected on fireproof filaments

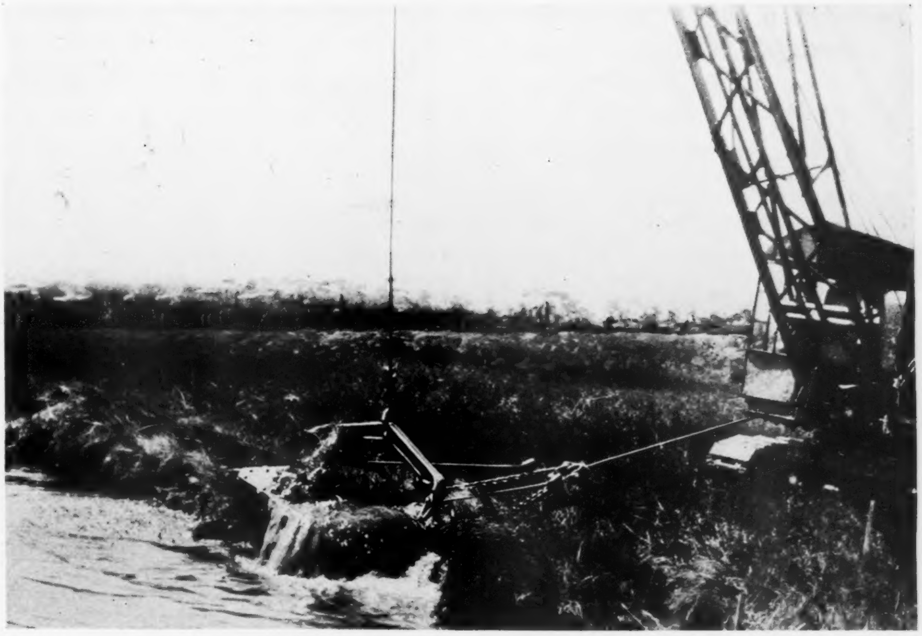
New Drag Line Bucket

THE Hayward Co., New York, N. Y., have recently put out a new addition to their line of drag line buckets in which many new features are said to have been incorporated. The bucket is for digging any material that does not have to be blasted. It can be handled by any type of operating machine with ranging lengths of boom. Sizes are from ¼ cu. yd. and up.

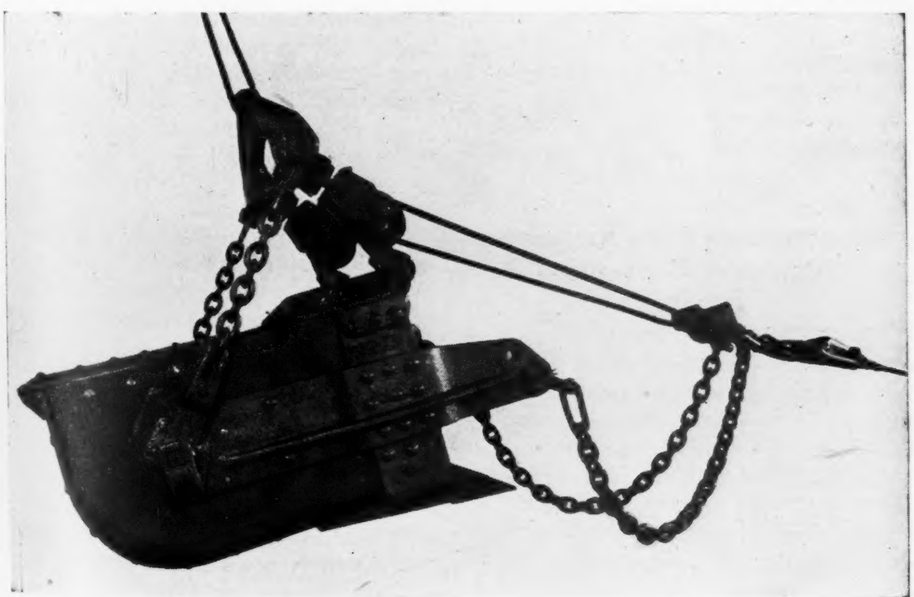
Some of the advantages claimed for the new bucket are quick operation, full carriage of material to boom end with little spillage, ease of operation, efficient digging and facilitation of dumping through short bridles and no obstruction to material passage from the bucket. The open front construction of other Hayward buckets has been retained in the design.

The cutting edge of the bucket is made of manganese steel and runs from the top of the bowl on one side, extending across the bottom to the top of the bowl on the opposite side. The bowl itself is made of reinforced steel plates and has stiffener runners to prevent wear on the bottom of the bowl plate. The digging bridles are made of hand forged steel dredge chain, as are the short carrying bridles. The adjusting bridles are made of steel wire cables. The bales and bridles are of the non-rigid type. Through adjustments between the hauling chain and the cables, the operator, it is said, can enter the bucket into the material at a desired angle. Another feature claimed for the bucket is the low head room required for its operation, which makes it possible to operate it from a short boom and also allows the making of higher spoil banks with fewer moves of the operating machine.

The sheaves on which the dumping cables are carried are made of cast steel, bronze-bushed, and fitted with swivel adjustment. Like all other types of Hayward buckets, this type is built on the interchangeable parts system. A "four-point pull" hauling bridle keeps the bucket in a predetermined position throughout its digging path, the manufacturers say, and the crushed spreader-bar is said to permit over-load to be dug and carried.



New dragline bucket in digging position at end of crane boom



New dragline bucket in carrying position. The bowl is of steel plates and the cutting edge of manganese steel

New Valve Plant on West Coast

OAKLAND, Calif., has been chosen for the location of the new western plant of the Merco-Nordstrom Valve Co., San Francisco, Calif. The new plant will supply the western territory and Mexico, while eastern points will be serviced by the Atlantic seaboard plant. Machinery for the new plant is now being ordered and it is expected that the plant will be ready to operate in the late spring or early summer.

The Merco-Nordstrom Co. was incorporated about three years ago as a subsidiary of the Merrill Co., San Francisco, to continue the manufacture and distribution of the Merco-Nordstrom plug valve based on the patents of S. J. Nordstrom. The valve, first introduced in 1916 for mining equipment in Mexico, has since been successfully used in the rock products industry, particularly in connection with cement mill machinery. The present officers of the company are: Charles C. Broadwater, president; Sven Johan Nordstrom, vice-president, and Herbert S. Shuey, secretary and treasurer, all of whom are also directors.

Reorganize Wire Rope Company

WITH the purchase of the Cochran interests by a syndicate headed by Robert Gilmore, Edgar Munson, Logan Cunningham and C. M. Ballard, the control of the Williamsport Wire Rope Co. passes into the hands of old employes, who put into immediate action the building of what is expected to be one of the biggest wire rope plants in America. The new organization while introducing new capital will not effect the personnel of the old organization.

Robert Gilmore, president, continues as the directing head, having been actively associated with the company for 34 years. The other officers are Edgar Munson, vice-president and treasurer; Logan Cunningham, vice-president and secretary, and C. M. Ballard, vice-president and general sales manager.

The new buildings include a 450x200-ft. structure which will be completely equipped with modern machinery. This will be utilized for the manufacture of the company's "Telfax" marked wire rope.

Norwegian Reply to H. Struckmann's Letter on Cement Importations

THE EDITOR—In your issue of November 27, 1926, I find an extract of a statement with reference to the import of foreign cement in the United States—presented to President Coolidge by H. Struckmann of the International Cement Corporation. Mr. Struckmann's deductions are so one-sided that I find a reply is necessary.

It is asserted that the approximately 10,000,000 bbl. of cement which have been imported from 1920 to 1926 have cost the American cement industry and the American railways, etc., about $29,000,000, which would seem to indicate that the average sale price for a corresponding quantity of American cement would have been $2.90 per bbl. As the imported cement has been sold at an average of $2.00 per bbl. the American consumers have saved about $0.90 per barrel or roughly $9,000,000, which, in any case, should be deducted from the estimate of the American "loss of prosperity." Moreover, these figures are more or less taken at random and hardly of special interest when it comes to an unbiased analysis of the case. It should also be remembered that the American cement industry has not always been able to meet the demand and that the import has to a certain extent satisfied an urgent need for cement. Thus in 1925 there was an extended railroad embargo on building materials for Florida and the contractors in the Miami district could obtain only insignificant amounts of domestic cement.

The total imports for last year, 1926, will presumably ascend to some 4,000,000 bbl. against an estimated American consumption of approximately 160,000,000 bbl. The imports thus represent only 2½% of the consumption.

It seems to me that Mr. Struckmann reckons with a good deal of credulity when on this basis he tries to create the impression that this import can prove to be of a destructive influence upon the American cement industry. A cursory glance at the balance sheets of the American cement mills these last years will show that this industry has experienced an advance in the production and can show such satisfactory amounts of profit that all talk of danger to its financial position or to the damage it has suffered is nullified by numerical facts. Of course, in an industrial group of the proportions as that of the cement line there will always be some unmodern and ineffectively managed mills, the final results of which may possibly not be as satisfactory as they ought to be, but it is not fair to quote these cases as proofs of the contention that the American cement industry is threatened by an importation of minimal proportions.

It is not, however, these details which call for special interest in this connection. Since the war the United States have taken the position as the leading creditor nation of the world and in order to get the loans with interests repaid they will have to import either gold, bonds or goods from their debtor nations. A steady flow of gold shipments to the United States would suit neither creditor nor debtors. The export of bonds from the debtor nations to the United States presumably also has its limitations. The only way therefore left for the United States to recover their money is to import from abroad a reasonable volume of goods. This is further emphasized by the dominating and unique position on the world market taken at present by the American export. Mr. Struckmann should remember that the value of America's total exports during the years 1920 to 1925 and including the first three quarters of 1926 aggregated (according to "Commercial Reports") about $33,623,000 against imports of about $25,850,000. Even if the assertion be correct that the United States has lost $29,000,000 on the cement imports, they have profited on their foreign trade to the amount of more than $7,773,000, which—assuming the case that every country of the world including the United States were to confine its industries and commercial activities to the domestic market alone—would not have been earned. The countries that paid this surplus should be allowed to sell some of their export goods in the United States, and the popular maxim advocated by Mr. Struckmann: "Myself alone, not you," has no lasting value in international commerce relations. The enormous American export interests represent such a purchasing factor, also for the American cement industry, that the sacrifice this industry is sustaining in the shape of the relatively insignificant cement imports practically does not count at all. Mr. Struckmann discards the idea of helping Europe "by hurting American business," but I venture to assert that nothing can hurt business more than misguided policies, and if all the American industries should take a standpoint as arbitrary with regard to the exchange of goods as professed by Mr. Struckmann, then a real danger to American prosperity would arise.

January 5, 1927.

CONSUL A. HOLTER,
Managing Director, A/G Dalen Portland-Cement Fabrik, Brevik, Norway.

Concrete Institute Prepares Attractive Convention Program

ENGINEERS and others of national prominence are among the speakers who will present papers at the national convention of the American Concrete Institute to be held at the Palmer House, Chicago, February 22, 23 and 24 next. The various institute committees will give their reports.

The program includes the following "Details in Making Cut Cast Stone," by H. P. Warner, president of the Onondaga Litholite Co., Syracuse, N. Y.; "Comparison of the Wet and Dry Methods of Making Cast Stone," Robert Havlik; "Mineral Colors for Concrete," Raymond Wilson, chairman, Committee T-2; "Aggregates for Cement," G. F. Laughlin, U. S. Geological Survey; "Time as a Factor in Making Cement" (discussion).

Dr. P. H. Bates, U. S. Bureau of Standards, a leading authority on cement technology, will discuss what happens to cement and to the rather diverse constituents of cement, which govern the period of manipulation of concrete after the water has been added, laying down a foundation for the program to follow.

Prof. Duff A. Abrams will present a paper on "Designing Concrete Mixtures" which will restate the water cement ratio theory, which has been greatly simplified.

Coincident with the Institute convention the Concrete Products Association will also hold its annual meeting at the Palmer House. The first day, February 22, will be devoted to commercial problems, advertising, promotion, etc., after which the products manufacturers will join the Institute in the two sessions especially designed for them, Wednesday, February 23.

The first concrete products session of the Institute will be for the consideration of problems in the work of standard concrete building unit production, at which time a round-table discussion will be also held.

Committee P-1, Standard Concrete Building Units, E. W. Dienhart, chairman, C. L. Bourne, secretary, will report on co-operation with Division of Simplified Practice, U. S. Department of Commerce, on standardization of sizes; on proposed amendments to the standard specifications offered by the committee on block, brick and structural tile; it will offer proposed standards for manhole block, and it will report on tests which are being made at the University of Michigan to determine water ratio influences in dry tamp mixtures.

Committee P-6, Concrete Products Plant Operation, Benjamin Wilk, chairman, will make a final report of the curing tests which were partially reported at the last annual convention. It will also make a preliminary report of the labor analysis, which the committee is undertaking with a view to its completion for the 1928 convention, of concrete building production.

Another feature of this session will be a symposium contributed to by several concrete building unit manufacturers on their experiences in designing concrete mixes.

Coal Firing at Nesher Cement Mill

THE superintendent of the Portland Cement Co., "Nesher," Ltd., Palestine, informs ROCK PRODUCTS that the automatic shaft kilns at the plant are entirely heated by anthracite coal and are not equipped with electrical furnaces as stated in the plant description published in the November 13, 1926, issue.

The rough wiring and set-up suggest that this motor is not favored by the best conditions. Allis-Chalmers Tex-rope Drive, an industrial sensation, particularly for short-center work, is here being used to belt a 50 h. p. Allis-Chalmers type ARY roller bearing motor to an Allis-Chalmers Gyratory Crusher.

The grinding rush of rock through a gyratory crusher forms one of the fiercest tests of electric motor performance. The shock loads on this job reveal the extra strength of Allis-Chalmers steel frames and positively locked cores. That Allis-Chalmers anti-friction motors are thoroughly practical for such rough, heavy work is evidence of greater bearing capacity also.

Allis-Chalmers motors equipped with Timken Bearings are protected not only against the wear and friction of radial loads, but also against thrust and shock. Timken tapered design compactly provides so much more capacity for every bearing stress that smaller housings and shorter shafts are actually possible.

Timken Bearings permit perfect enclosure, keeping all grit out, and retaining all the lubricant, which never needs attention more than a couple of times yearly! That is all it takes to maintain the correct gap permanently, even on the toughest, most exposed jobs. These bearings protect the windings from soaking, and the special Allis-Chalmers insulation process means permanent protection against weather and dust.

More than likely there are some profit possibilities for you in all these Allis-Chalmers superiorities. Consult the nearest office.

ALLIS-CHALMERS MANUFACTURING CO., MILWAUKEE

District Sales Offices in All Principal Cities

ALLIS-CHALMERS MOTORS

News of All the Industry

Incorporations

Huron Gravel Co., 739 Taylor Ave., Detroit, Mich., $250,000. Gravel and stone.

Holmes & Binkley Co., Tampa, Fla. S. R. Binkley, 2702 Oakland St., and others.

Ocala-Tampa Lime Rock Co., Inc., Tampa, Fla. W. I. Webb, 1925 Bayshore Blvd., and others.

Riverside Quarries, Inc., Pasadena, Calif., $7,500. N. J. Shupe, Robert L. Newby and Charles A. Goodale.

Chipley Lime Products, Inc., Tallahassee, Fla., $40,000. A. R. Richardson, W. T. Wallis, Jr., and others.

Gulf Coast Shell and Cement Co., Houston, Texas, $10,000. A. E. Wickham, J. E. Reed and C. S. Zerby.

Winchester Sand and Gravel Co., Winchester, Ky., $30,000. J. C. Codell, R. D. Blanton and H. C. MacNeill.

Amiesite Asphalt Co. of Indiana, $100.000. T. L. Croteau, Wilmington. (Corporation Trust Co. of America.)

Amiesite Asphalt Co. of Michigan, $100,000. T. L. Croteau, Wilmington. (Corporation Trust Co. of America.)

Olympia Concrete Products Co., Olympia, Wash., $20,000. Ray F. Wood, Fred W. Stocking and Gerry Lemon.

Downer Silica Co., Downer, N. J., 1000 shares no par. Samuel P. Hageman, Blackwood. To deal in sand and silica.

Moosic Sand and Gravel Co., Wilmington, Del., $15,000. G. W. Bone, Scranton, Penn. (Capital Trust Co. of Delaware.)

Sherman Stone Manufacturing Co., Inc., Houston, Texas, $10,000. C. T. Sherman, George B. Stone and Hugh B. Stone.

North Loop Gravel Co., Inc., San Antonio, Texas, $50,000. E. V. Biles, 141 Mont Clair St., James Donaldson and M. L. Roark.

Washington-Hume Concrete Pipe Co., Seattle, Wash., $49,000. H. W. Brautigan, M. W. Cassmore, Charles M. Farrer, and others.

Streklow Cut Stone Co., New York, N. Y., $10,000. M. and Y. and W. Streklow. (Filed by C. B. Basfield, 350 Stone Ave.)

Quinn Stone and Ore Co., Ltd., Port Arthur, Ont., Canada, $200,000. Clement K. Quinn. To quarry and deal in stone, rock, gravel, clay, sand, etc.

Southern Sand and Gravel Co., Inc., Wilmington, Del., $100,000. J. M. Frere, J. A. Frere and C. R. Murphy. (American Guaranty and Trust Co.)

Broken Stone Co., Deerfield, Mass., 100 shares, no par value. President, Arthur J. Wellington; treasurer, Henry O. Robinson, Brookline, and C. Oliver Wellington.

General Cement Products Corp., Pittsburgh, Penn., $10,000. John E. Crawford, 2438 Pioneer St., treasurer; Park J. Alexander and Jerome A. Miller, all of Pittsburgh.

Gulf Quarries Co., Camden, N. J., 100 shares, no par value. J. P. Murray, Frank S. Muzzey, F. Stanley Sauerman, Philadelphia. (Attorney, Henry H. Savage, Audubon.)

American Gypsum Products Co., Salt Lake City, Utah, $500,000; 500,000 shares. J. A. Egildson, president; E. J. Miltenberger, vice-president; A. N. Leonard, secretary-treasurer; D. P. Thomas, O. A. Egildson.

Bessemer Limestone and Cement Co., Dover, Del., $16,800,000, 168,000 no par value shares, 60,000 Class A, 108,000 Class B. T. L. Croteau, A. L. Miller, Alfred Jervis, Wilmington. (Corp. Trust Co. of America.)

Quarries

Quinn Stone and Ore Co., Ltd., recently organized at Port Arthur, Ont., Canada, with a capital of $200,000, is said to have installed Dorr washers in its plant like those used on iron ore for washing crushed trap rock.

Monarch Cement Co.'s new crushing plant now under construction at Lost City, near Tulsa, Okla., is rapidly approaching completion. The company will produce roadstone and aggregate, utilizing the limestone deposits along the Arkansas river. The estimated cost of the plant is about $100,000, including equipment.

General Crushed Stone Co., Quarry, Md., recently had its main office threatened by fire, but employes succeeded in putting out the blaze before it spread to the outside walls and nearby buildings. Considerable damage was done to the interior, however, many valuable papers being lost, typewriters destroyed, and the greater part of the furniture ruined.

Sand and Gravel

L. E. Simpson has leased 70 acres of land near Milton, Fla., and will develop the sand and gravel deposits thereon. Plans for the construction of a $30,000 plant, capacity 400 to 500 cu. yd. daily, are under consideration, it is said.

Pioneer Sand and Gravel Co., Seattle, Wash., will build a frame office and warehouse structure at 2501 Northlake Ave., a report states, at an estimated cost of $2500.

Fox Island Gravel Co., Shelby, Wis., elected the following officers and directors at its annual meeting held January 10: President and first vice-president, Victor Ruckels; second vice-president, P. W. A. Fitzsimmons; secretary, V. E. Cooper; treasurer, C. L. Churchill, Jr.; directors, the foregoing officers and Wm. H. Fisher, Mark H. Hunks, Chester B. Thayer and John Toner.

Tractor City Sand and Gravel Co., Janesville, Wis., recently completed remodeling and making additions to its plant, thereby increasing the capacity more than 25%, it is said. Oscar G. Olson is president and general manager.

McGrath Sand and Gravel Co., Lincoln, Ill., in its annual business meeting is reported to have elected the following officers: President, J. W. McGrath; vice-presidents, T. L. Blackburn and T. E. McGrath; treasurer, Fred W. Longan; secretary, Thomas P. McGrath, and assistant secretary, Dean Hill. The directors include the officers and J. J. English of Chicago.

Gemmer & Tanner, Houston, Texas, plan the development of gravel pits at Eagle Lake, Texas, within the near future, it is reported. A plant will be erected, tracks laid, etc.

Lime

Standard Lime and Stone Co., Fond du Lac, Wis., announce the re-election of the following officers at its annual meeting: President and treasurer, W. A. Titus; vice-president, V. M. Weeks; secretary, Clo Czarnezki. At the stockholders' meeting the former directors of the company were re-elected as follows: W. A. Titus, V. M. Weeks, Atty., D. D. Sutherland, M. F. O'Brien, Otto Frerk, Fred Kreachman and Edward Tesch. Improvements during the past year included a new kiln, it is said, and a grinding plant erected at Valders, Wis.

Tacoma Lime Co., Tacoma, Wash., has changed its name to the International Lime Products, Inc.

Mississippi Lime and Material Co., Alton, Ill., reports that three employes were injured in an explosion at its quarry near there recently. The men were Eugene M. Hilner, superintendent; Daniel Frobes, mining engineer, and James Zero. The men thought, it is said, that a series of six dynamite explosions had been completed, but when they entered the shaft another explosion occurred.

C. L. Gordon, Pasadena, Calif., will start the manufacture of hydrated lime and putty at 209 South Pleasant Ave., that city, within the near future, according to a report. Four tanks have already been installed.

Gypsum

Blue Diamond Co., Los Angeles, Calif., at its annual meeting elected William C. Hay, Rebecca H. Hay and N. J. Redmond to comprise the company's board of directors for the ensuing year. The board organized by electing William C. Hay, president; Rebecca H. Hay, vice-president, and N. J. Raymond, secretary-treasurer.

Digby, N. S., Canada—An American gypsum company, it is rumored, has inspected and taken an option on several sites of land on Annapolis Basin here. A report states that the erection of a $100,000 shipping plant is proposed.

Cement

National Cement Co., Birmingham, Ala., is reported to have just completed 14 concrete storage silos and installed additional electrical equipment at its plant at Ragland, Ala. George E. Nicholson is president.

Colorado Portland Cement Co., Denver, Colo., is going ahead steadily, it is said, with the construction of its new plant at Boettcher, Colo., despite the winter weather. Two 14x175-ft. kilns were installed recently.

Cement Products

Bakersfield, Calif.—The California Association of Concrete Pipe Manufacturers, which held a meeting in this city on January 8, voted to hold the annual midsummer meeting in San Francisco, Calif., on July 15 and 16. An attempt will be made to bring the convention of the Northwest Association of Concrete Pipe Manufacturers to San Francisco at the same time for a big joint convention.

Alabama Roofing Tile Co., Birmingham, Ala., organized last August, is reported to have established a plant on Avenue A and 39th St., and to have the business well under way. Concrete roofing tile in various colors and patterns is manufactured. The plant is equipped with new machinery and other equipment.

Fred Shields, Omaha, Nebr., building materials, is contemplating the construction of a concrete block plant with a capacity of 2000 block per day at 39th and Fort Sts. A warehouse and office building will also be built. The Northwestern railroad will build a spur track to the site.

Fergus Falls Tile Works, Fergus Falls, Minn., has changed its name to the Fergus Falls Concrete Pipe Co. The product is a concrete drainage tile. T. H. Culligan is president and C. C. Potter, secretary.

A. C. Hyslop & Co., Poplar Bluff, Mo., is planning the erection of a 50x180-ft. plant with concrete floors and tin roof. A brick press furnished by the Haydenite Brick and Machine Co., St. Louis, Mo., will be installed. A. C. Hyslop is manager.

Concrete Products Co., Birmingham, Ala., is said to be enlarging its plant and installing new machinery, which includes new mixers, color mills, electric motors, etc. The company manufactures cement roofing tile principally. F. G. Smithson is manager.

American Concrete Products Co., Inc., Chicago, Ill., has moved its office from 30 N. La Salle St. to the manufacturing plant of the company on Circle Ave., south of Roosevelt Rd., in Forest Park, Ill. The company, which has been in business for eight years, has been reorganized, it is said, and is preparing for expansion. D. B. Hanna is manager. The general product of the company is concrete street lighting posts, but concrete benches and fountains are manufactured as a side line.

Olympia Concrete Products Co., Olympia, Wash., recently incorporated for $20,000 as announced in this issue, has leased a section of land on the Thurston port property, according to reports, and will start work on a plant within the near future. Concrete pipes will be manufactured. Roy F. Wood is president. The plant is expected to be in operation by the latter part of March.

Gray Concrete Co., Thomasville, N. C., has increased the capacity of its plant by the addition of a new machine for the manufacture of concrete reinforced and plain wall sewer and culvert pipe. In addition to manufacturing sewer and culvert pipe, the Gray company also turns out drainage tile and cement building blocks.

Slag

Buffalo Slag Co. has started work on the construction of a new slag crushing unit adjacent to the plant of the Perry Iron Co., Erie, Penn. After the new crushing plant is in operation the present slag shipments to the Buffalo, N. Y., crushing plant will be stopped.

Miscellaneous Rock Products

Amiesite Asphalt Co. of America, Little Rock, Ark., is said to have acquired property on East Ninth St. and plans the construction of a new rock crushing and distributing plant, with a daily capacity of 350 tons. The estimated cost of the plant is $40,000 with equipment. Headquarters are at 235 S. Fifteenth St., Philadelphia. John A. Butler is district manager at Little Rock.

Superior Flake Graphite Co., Chicago, Ill., at present leasing a plant at 3612 S. Morgan St., has concluded negotiations for the erection of a plant of 25,000 sq. ft. at 66th St. and South Laramie Ave., according to a report. Foltz & Co., architects, are preparing plans for the plant, which, it is expected, will be completed by May 1.

Harford Talc Co., Inc., Baltimore, Md., reported to be installing a 3000-ft. cableway in the January 22 issue of "Rock Products," is now installing the second cableway unit, according to President W. C. Boswell, and expects to have it in operation within 60 days.

Personals

John T. Settle, vice-president of the Ohio River Sand Co., Pittsburgh, Pa., and Mrs. Settle, recently left Honolulu for Japan and the Orient.

Henry J. Parker has been appointed representative of the Portland Cement Association at Santa Barbara, Calif., succeeding George F. Allen.

Robert G. Stone, Boston, Mass., has been elected to the board of directors of the International Cement Corp., New York. Mr. Stone succeeds his father, the late Galen L. Stone.

E. A. Chamber has been appointed superintendent of the sand and gravel plant of the King Crown Plaster Co., Cedar Rapids, Iowa. This company is installing a new 10-in. Morris Machine Works pump dredge and making other extensive improvements and additions.

Alonzo T. Walter, for 24 years secretary of the Lehigh Portland Cement Co., Allentown, Penn., was elected to the directorate at the annual meeting of the company's stockholders which was held recently. The other directors are General H. C. Trexler, Colonel E. M. Young, George K. Moser and Daniel E. Ritter.

C. E. Ireland, vice-president and sales manager of the Birmingham Slag Co., Birmingham, Ala., was re-elected vice-president of the National Slag Association.

Obituaries

Anson Wood Burchard, vice-chairman of the board of directors and chairman of the executive committee of the General Electric Co., Schenectady, N. Y., and chairman of the board of directors of the International General Electric Co., died January 22 of acute indigestion at the home of Mortimer L. Schiff, with whom he was lunching, in New York City. Funeral services were held Tuesday morning from his late home, 690 Park Ave., New York, and were in charge of Dr. Robert Norwood, rector of St. Bartholomew's Church. Burial was at Locust Valley, L. I.

Ephraim Cline Sooy, president of the Kansas City Hay Press Co., Kansas City, Mo., died January 8.

Ralph E. Hagen, secretary of the Monighan Machine Co., Chicago, Ill., died January 19.

J. C. Conery, proprietor of the Royal Artificial Stone Co., Guelph, Ont., Canada, died in that city on January 20. He was 68 years old.

Manufacturers

Komnick Machinery Co., Inc., has been recently incorporated under the laws of the state of Michigan for the manufacture and sale of machinery and equipment for the production of sand-lime brick, slag-lime brick and asbestos-cement roofing material. The company will act as exclusive distributors of F. Komnick machinery in the United States and Canada. The officers of the company are Louis Bollen, president and treasurer; Frank Wawrousek, vice-president, and Arthur Reinhold, secretary. A. F. H. Seelig is consulting engineer and representative for the district west of the Mississippi, with office at St. Louis, Mo.; L. M. Bauer is consulting engineer and architect for the Central district, with office at Detroit, Mich., and Frank Wawrousek, Jr., is the Eastern district consulting engineer, with office at New York City.

Mundy Sales Corp., New York, announces the following appointments of new distributors: W. H. Anderson Tool and Supply Co., Grand Rapids, Mich., for western Michigan; Cyril J. Burke, Detroit, Mich., all of eastern Michigan with exception of Lenawee and Monroe counties; Cunningham-Ortmayer Co., Milwaukee, Wis., for the state of Wisconsin, and R. W. Simpson, Cedar Rapids, Iowa., for the state of Iowa.

Northwest Engineering Co., Chicago, Ill., had an interesting display at the recent Road Show at Chicago. One of the features shown was its model

An exhibit which attracted attention at the Chicago Road Show

No. 104 shovel, which was equipped with 1¼-yd. manganese steel bucket. The bucket-load of beautiful young ladies attracted many visitors.

Hill Clutch Machine and Foundry Co., Cleveland, Ohio, recently appointed Charles C. Phelps, 473 Getty Ave., Paterson, N. J., as representative sales engineer for the metropolitan New York and northern New Jersey district.

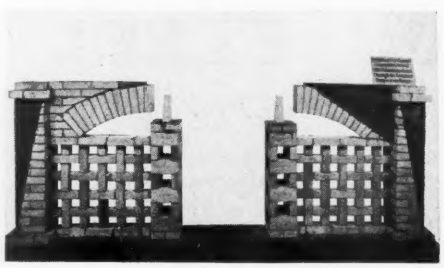
L. B. Foster Co. has recently opened up a Chicago office, Suite 1764 in the Illinois Merchants Bank Bldg., 231 La Salle St., in charge of R. A. Foster, vice-president of the company.

Relay Motors Corp., recently incorporated to take over the assets of the Commerce Motor Truck Co. of Ypsilanti, Mich., and Service Motors, Inc., Wabash, Ind., announce the following new officers of the amalgamated company: W. R. Bassick, chairman of the board; G. L. Gillam, president; M. A. Holmes, vice-president; A. K. Tabor, secretary and treasurer.

Botfield Refractories Co., Philadelphia, Penn., announce the following new distributors: Southern Steel and Cement Co., Asheville, N. C.; Henry A. Petter Supply Co., Paducah, Ky.; Columbia Supply Co., 823 W. Gervais St., Columbia, S. C., and Spartanburg Mill Supply Co., 218 Ezell St., Spartanburg, S. C.

Worthington Pump and Machinery Corp. has purchased all the patents, drawings, patterns and good-will of the Harris Air Pump Co., Indianapolis, Ind., manufacturers of air left systems and pumps. The Worthington company is now in position to offer complete well equipment, including compressors produced in its own plants.

Botfield Refractories Co. has arranged for an interesting exhibit illustrating the use of "Adamant" fire brick cement at the forthcoming Midwestern Engineering Exposition at Chicago, February 15 to 19. Two unusual single ring arches in which 150 lb. of refractories are supported by a thin layer of "Adamant" cement will be displayed.



Refractory exhibit at Engineering Exposition

In addition there will be shown other of the uses of "Adamant" cement as well as data on the company service. The booth will be in charge of A. H. Engstrom, sales manager of the company.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention ROCK PRODUCTS.

"Jalcase" Steel. Pamphlet on new open-hearth steel adapted for case hardening and forging manufactured by JONES & LAUGHLIN STEEL CORP., Pittsburgh, Penn.

Industrial Speed Reduction. Bulletin on "Boston" standardized speed reducers in various types, sizes and ratios. Specifications, prices, etc. BOSTON GEAR WORKS' SALES CO., Norfolk Downs, Mass.

From the Ore to the Bolt. Picturized description of the Upson works showing the manufacture of bolts and nuts from the ore to the finished product. THE BOURNE-FULLER CO., Cleveland, Ohio.

Blake Type Jaw Crusher. Bulletin No. 2097 on various types of Blake type jaw crushers. Details, specifications, capacities and equipment data. TRAYLOR ENGINEERING AND MANUFACTURING CO., Allentown, Penn.

Engineering Achievements in 1926. Review of the year's technical developments and achievements by the WESTINGHOUSE ELECTRIC AND MFG. CO., East Pittsburgh, Penn.

Autocar Road Book for 1927. Seventh annual review of the relation of "Autocar" trucks to the road building industry. THE AUTOCAR CO., Ardmore, Penn.

Diamond Drills. Bulletin **80-B** on class "N" for deep structure testing, portable or mounted diamond drill and Bulletin **80-C** on "Turbinair" diamond drill for surface or underground prospecting. Details, illustrations and construction data. SULLIVAN MACHINERY CO., Chicago.

General Electric Bulletins. GEA-571 on arc welding accessories.

General Excavator. Bulletin No. 2701 describing and illustrating ½-yd. combination power shovel, crane, etc. Data on design, specification, capacities and other details. THE GENERAL EXCAVATOR CO., Marion, Ohio.

Fifty Years of Progress in Trade Journalism

DECEMBER 2, 1876, marked the date of the first issue of a new publication, the *Tonindustrie-Zeitung,* which contained among other things scientific and technical articles bearing on the clay, lime and cement industries in Germany. At the same time there was established a testing laboratory to be operated in conjunction with the journal. The founders, Dr. Herman Seger and Dr. Julius Aron, were man who had established for themselves enviable reputations in the scientific world. The success of the journal and the laboratory was assured from the start and the new journal continued on a career of service to its industries which up to the present day has remained unbroken.

In commemoration of its golden anniversary the *Tonindustrie-Zeitung* has brought out a special issue in which the technical progress of the past 50 years is reviewed. There are brief articles from the foremost European authorities on the clay and rock products industries. The laboratory work is carried out on a larger scale than ever, many of the different associations of Germany carrying out their important investigations there.

ROCK PRODUCTS wishes at this time to felicitate its German contemporary on its splendid success and hopes that its future years will be even greater than those of the past. Its work has been of value not only to German industry but to that of the entire western world.